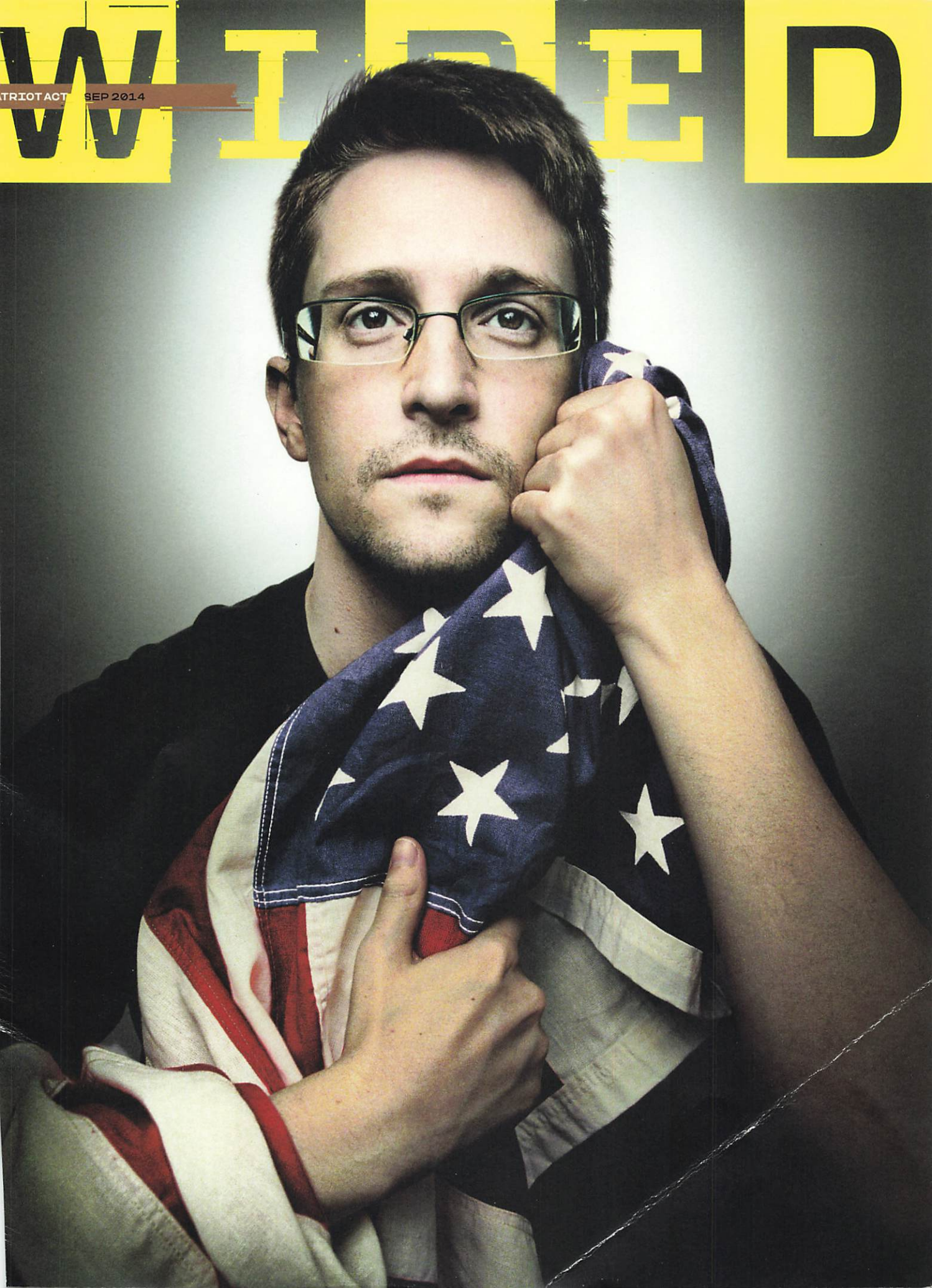
WIRED

ATRIOT ACT SEP 2014



YOU COULD FIT YOUR IN-LAWS IN THE BACK.

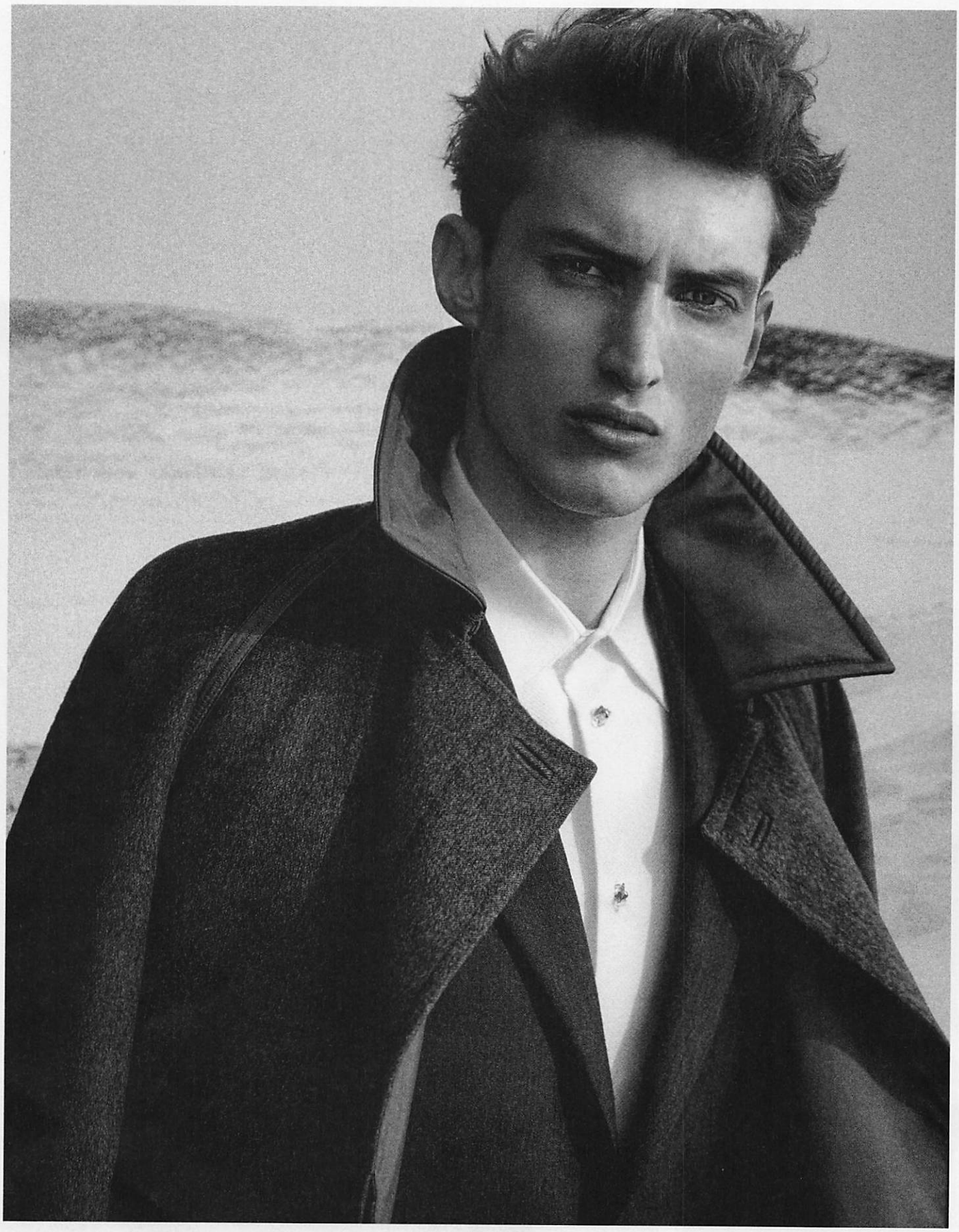
YOU WON'T, BUT YOU COULD.

© 2014 General Motors. All rights reserved. Cadillac® ATS Coupe

Cadillac

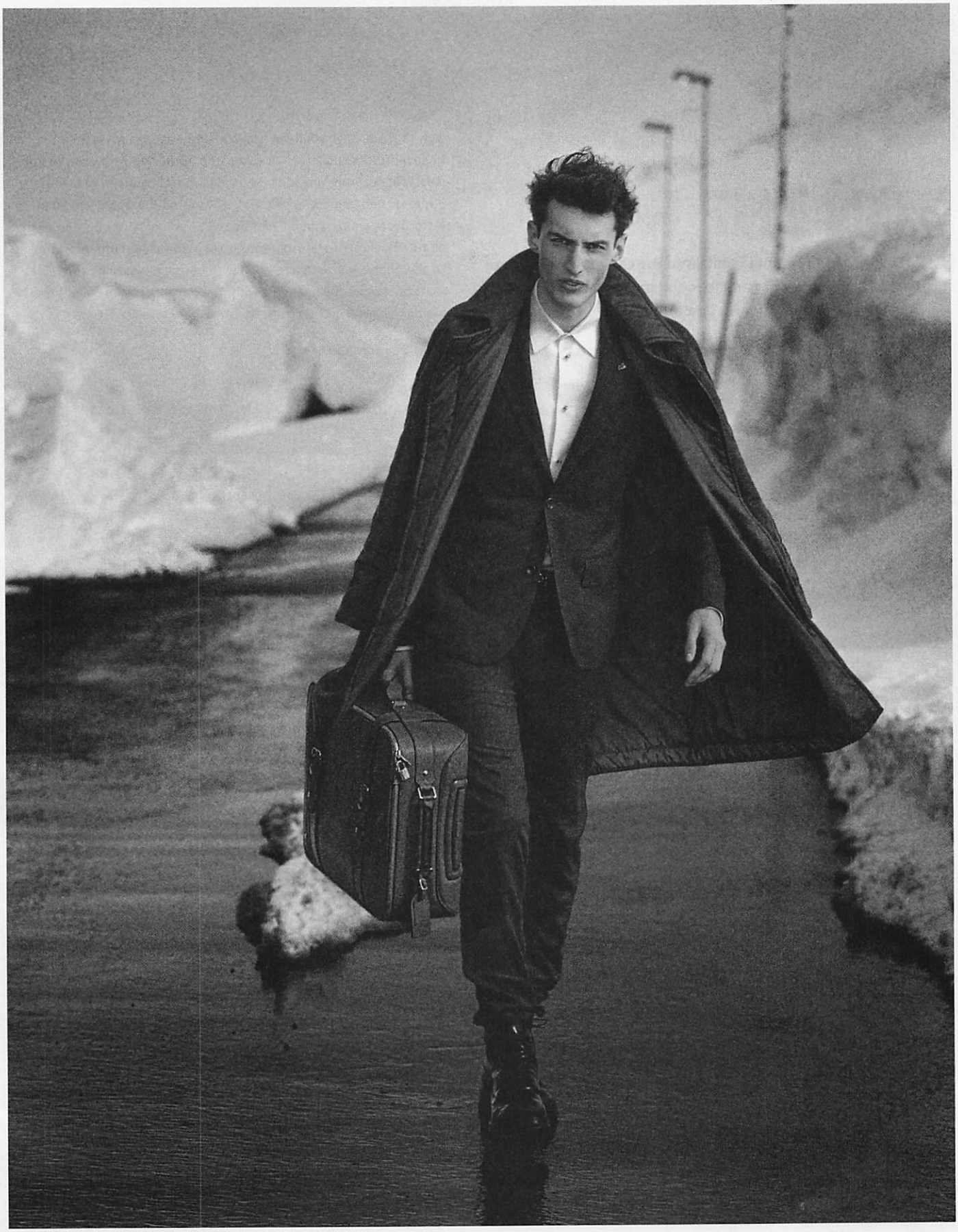
ALL NEW
2015 ATS
COUPE

272 HP 2.0L Turbo engine with 295 lb-ft of torque
Available Magnetic Ride Control adaptive suspension
Brembo® race-inspired front brakes
cadillac.com/ATScoupe



Sold exclusively in Louis Vuitton stores and on louisvuitton.com 866·VUITTON

Download the Louis Vuitton pass app to reveal exclusive content.



LOUIS VUITTON

ADVERTISEMENT

BOLDLY GO ON THE ROAD

You loaded the whole family into the car with the luggage and the dog. You have snacks and games and tablets and phones. And headphones. Can't forget the headphones.

Now that you have your whole brood into the car and on the road to adventure, you can relive every step of the trip with your handy smartphone. From the audio and video to still pictures and status updates, you can capture it all with that boldly-going-anywhere waterproof smartphone case. But what you may not be thinking about? Backing up your laptop to keep all these moments safe. Or the phone you're taking them with before it syncs. Or the tablet that you'll share the moments with. You put a lot into making these memories, protect them with Norton 360™ Multi-Device.

BOLDLY GO ADVENTURING

These are the vacation activities that the whole family can enjoy for one last summer fling.

ZIP LINING
Bear Mountain, NY
Grab an action camera and strap in. This wild ride through the trees and over the canopy is the best way to see a new location and get a bold rush of adrenaline as you explore the last days of lush, green forest.

KAYAKING ADVENTURE
Bryson City, NC
Paired with a hike and a barbecue picnic, kayaking the shores of the Carolinas will open up your family to a new world of wildlife and tranquility. If you can peel them away from their devices.

WATER SKIING
Lake Minnetonka, MN
Selfies while skiing are the next frontier of self-photography. But whether you're on a beach or a lake, this activity will get the whole family active and cool for the long summer weekend on the water.

Norton by Symantec

Norton 360™ Multi-Device actively protects you from viruses, spam, identity theft and social media dangers across all of your devices, constantly scanning for suspicious links and content. Learn more at norton.com/multi-device.

BOLDLY GO
KEEP MOM IN THE LOOP.

Show her all the good stuff she's missing. And keep it secure with Norton 360™ Multi-Device, which gives you on-the-fly protection for your most personal information. So you can go boldly, not blindly.

Norton.com #BoldlyGo

Copyright © 2014 Symantec Corporation. All rights reserved. Symantec, the Symantec Logo, the Checkmark Logo, Norton, and Norton by Symantec are trademarks or registered trademarks of Symantec Corporation or its affiliates in the U.S. and other countries. Other names may be trademarks of their respective owners.

Norton™ by Symantec

OTHER TEQUILA MAKERS DON'T HAVE THE STONES.

PATRÓN IS ONE OF JUST A HANDFUL OF ARTISANAL TEQUILA MAKERS STILL USING A TAHONA STONE WHEEL TO CRUSH COOKED AGAVE, AN ANCIENT, LABOR-INTENSIVE PROCESS. THE AGAVE IS THEN FERMENTED AND DISTILLED WITH THE FIBER, GIVING NEW ROCA PATRÓN A COMPLEX, EARTHY TASTE. EXPLORE THE PROCESS AT PATRONTEQUILA.COM. TASTE HOW IT'S MADE.™

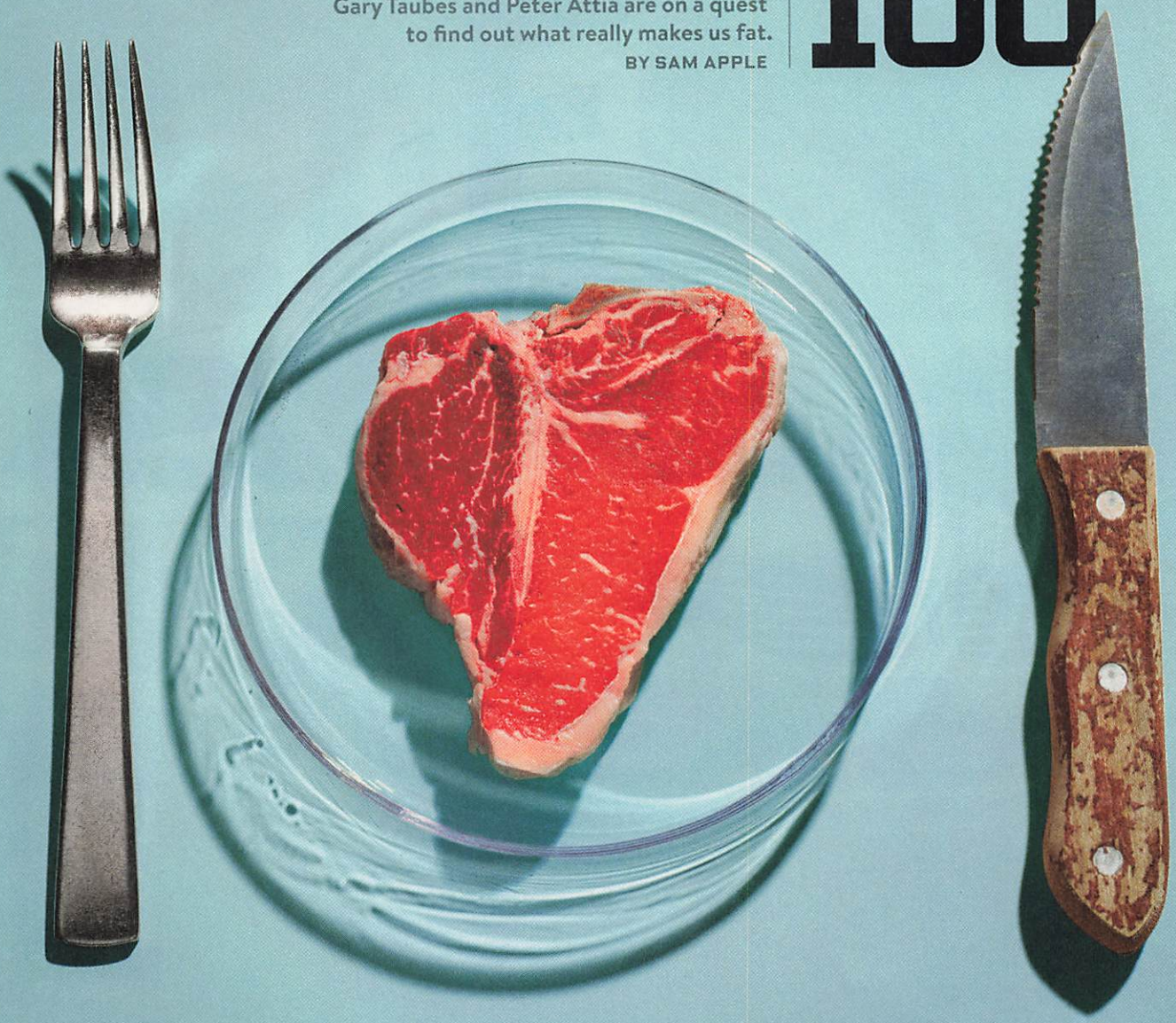
The perfect way to enjoy Patrón is responsibly. © 2014 Handcrafted and Imported exclusively from Mexico by the Patrón Spirits Company, Las Vegas, NV, 42-45% abv.

ALL YOU CAN EAT

Gary Taubes and Peter Attia are on a quest to find out what really makes us fat.

BY SAM APPLE

100



78

THE MOST WANTED MAN IN THE WORLD

The untold story of Edward Snowden.

BY JAMES BAMFORD

96

HOW TO SAVE THE NET

BRUCE SCHNEIER, REED HASTINGS, DANNY HILLIS and other experts have a plan to bring the Internet back from the brink.

106

TERMINAL VELOCITY

The battery-powered rocket car that could supercharge Formula One racing.

BY JASON FAGONE

108

THE A.I. THAT KNOWS YOUR MIND

From the people who brought you Siri comes Viv, a new attempt to meet your every need.

BY STEVEN LEVY

112

THE DARKEST KNIGHT

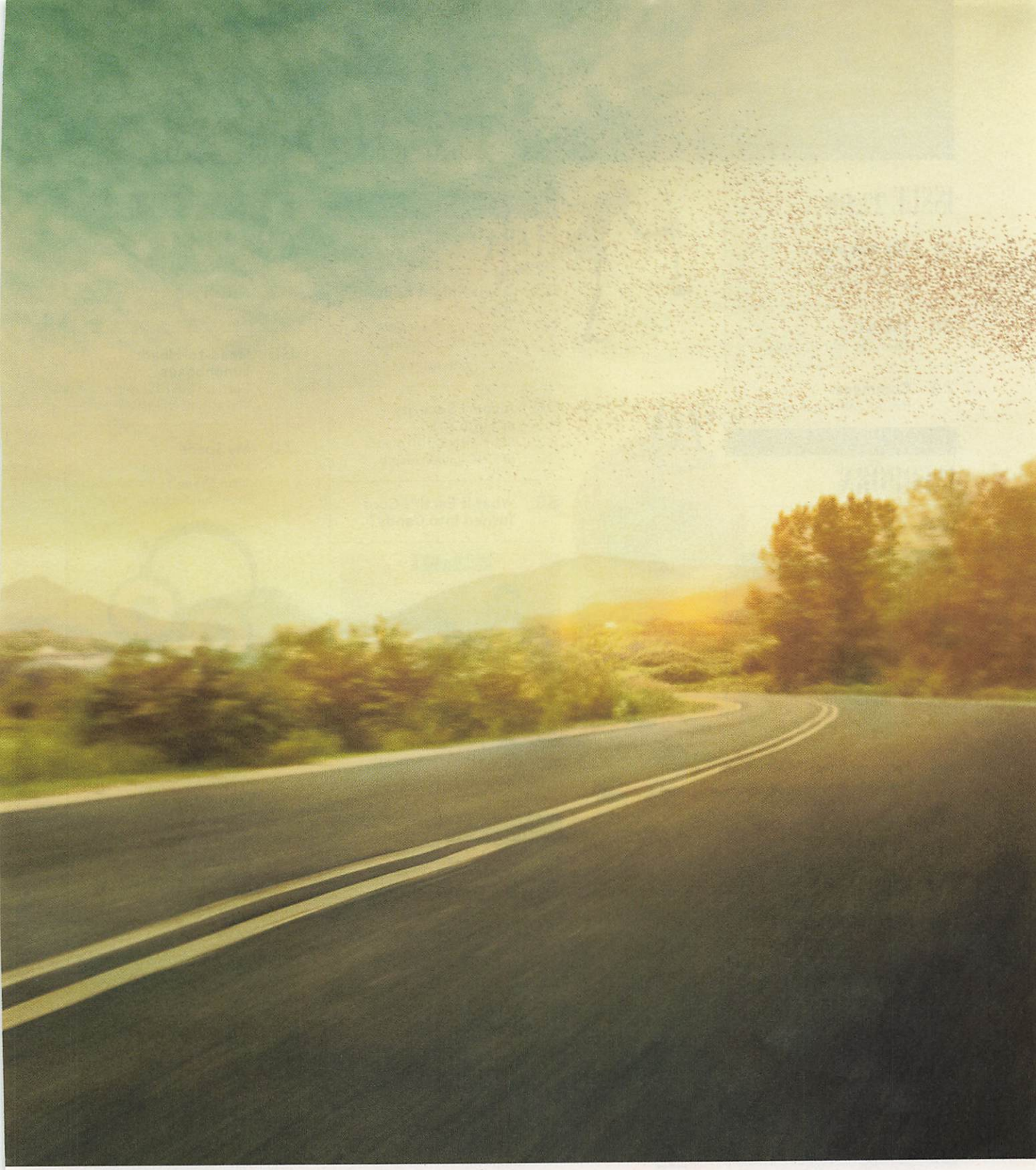
Frank Miller was a comic book pioneer, but he sabotaged his legacy. Will the new *Sin City* redeem him?

BY SEAN HOWE

THE FIRST-EVER LINCOLN MKC. LIVE IN YOUR MOMENT.

Feel free to take on whatever chaos comes your way, with the turbocharged EcoBoost® engine and active noise control technology in the 2015 MKC.

Experience the MKC at **Lincoln.com/MKC.**



THE LINCOLN MOTOR COMPANY

ISSUE 22.09

12 **The Network**
What's happening in the WIRED world

20 **This Issue**
From the editor's desk

24 **Comments**
Reader rants and raves

INFOPORN

White-Collar Labor

ALPHA

31 **Oh Pioneers!**
India, Manifest Destiny, and the myths of Silicon Valley
BY VIKRAM CHANDRA

34 **Jargon Watch**
The latest additions to the WIRED lexicon

36 **Alpha Geek**
Heather Willauer is turning seawater into jet fuel

38 **New Black Markets**
A different Dread Pirate Roberts rises

38 **Garbage Collector**
One company's trash is another startup's business model

40 **Trunk Show**
A pachyderm robot

40 **First to Market**
Secondhand clothes →

42 **The New Library**
A place to make stuff, not just learn stuff
BY CLIVE THOMPSON

ULTRA

45 **Travis Knight Calls the Shots**
The animator for *Coraline* takes on *The Boxtrolls*
BY CAITLIN ROPER

50 **Airport Security as High Art**
Start with 8,000 pieces of CNC-milled maple

52 **What If Earth's Core Turned Into Candy?**

54 **Fall TV Preview**
Jonah Ray and Kumail Nanjiani tell you what to watch this month

Q:

57 **Toxic Hunger**
A new, portable plant for gobbling up chemical weapons

58 **What's Inside:** →
Sriracha hot sauce

60 **Beyond the Blimp**
Goodyear's next airship

62 **Mr. Know-It-All**
On how to fight with your spouse
BY JON MOOALLEM

64 **Process: Crayola**
Inside the factory that makes Cerise and Burnt Sienna

GADGET LAB

67 **Fetish**
Pininfarina Cambiano pen

68 **Head-to-Head: Lunchboxes**
Carriers built for more discerning appetites

70 **My Space**
Headphone guru John Grado's Brooklyn factory

72 **Split Screen: Daytrader**
Stay abreast of market moves with the right tools

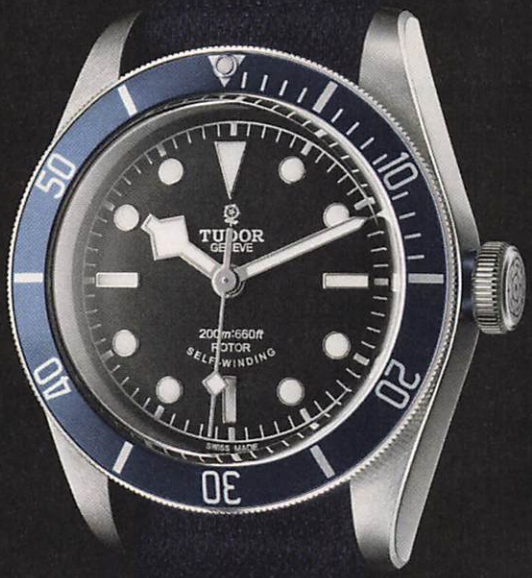
74 **You Can Have Anything Delivered Nearly Instantly. Now What?**
BY MAT HONAN

ASK A FLOWCHART

122

Am I Hurting the Internet?
BY ROBERT CAPPS

ON THE COVER
Photograph for WIRED by Platon



1954 **60 YEARS OF CONTINUOUS INSPIRATION IN THE PURSUIT OF TECHNICAL PERFECTION**

Heritage Black Bay is the direct descendant of TUDOR's technical success in Greenland on the wrists of Royal Navy sailors. 60 years later, the Black Bay is ready to stand as its own legend.

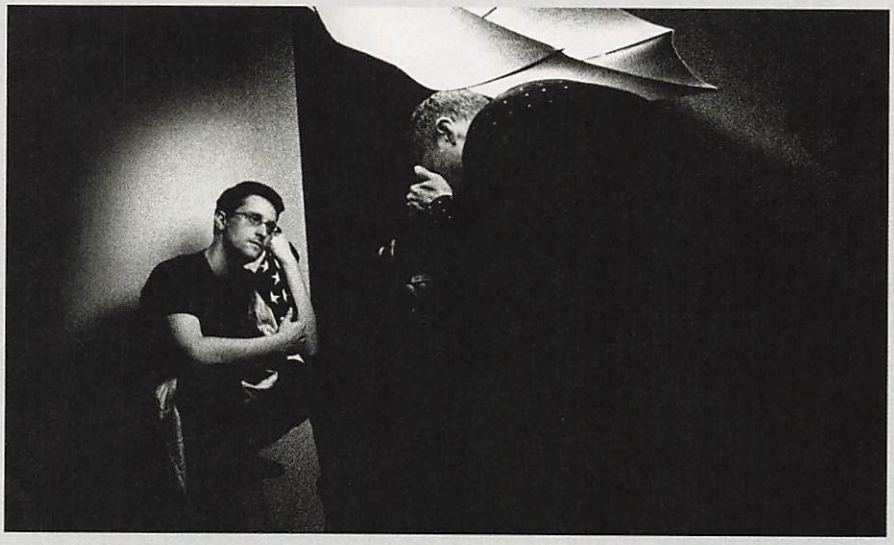
TUDOR HERITAGE BLACK BAY®

Self-winding mechanical movement, waterproof to 200 m, 41 mm steel case.
Visit tudorwatch.com and explore more. TUDOR Watch U.S.A., LLC. New York

TUDOR

WATCH YOUR STYLE®

VIDEO



Snowden Sounds Off

Our exclusive interview with Edward Snowden doesn't end with the article on page 78. On WIRED.com and in our tablet edition, you can go behind the scenes of the Moscow photo shoot with Platon, plus watch videos featuring conversations between Snowden and writer James Bamford.

ON THE WEB: WIRED.com

SOCIAL

Jonah & Kumail

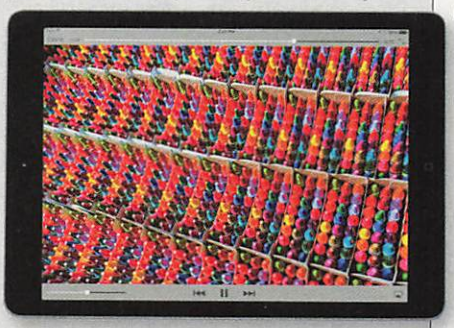
The '70s-tacky living room in which Jonah Ray and Kumail Nanjiani, stars of the new Comedy Central series *The Meltdown With Jonah & Kumail*, gave us a preview of the fall TV season (page 54) really does look like that. You might remember it from such porn-related material as the movie *Boogie Nights*. Follow WIRED's Instagram feed for more photos from our hangout with the dudes behind *The Meltdown*.

ON INSTAGRAM: @WIRED

TABLET/VIDEO

Waxworks

Download the WIRED app for tablet to watch how paraffin wax gets colored, shaped, labeled, and packaged into yellow boxes of joy at Crayola's factory.



WEB

Innovation Insights

WIRED's Innovation Insights blog dissects issues facing businesses today.

ON THE WEB: WIRED.com/insights

WHO WE FOLLOW

Barton Gellman @bartongellman

Glenn Greenwald @ggreenwald

Chris Soghoian @csoghoian

Ashkan Soltani @ashk4n

Kim Zetter @KimZetter

Andy Greenberg @a_greenberg

Matt Blaze @mattblaze

Julian Sanchez @normative

Matthew Green @matthew_d_green

Mitchell Baker @mitchellbaker

Runa Sandvik @runasand

Bruce Schneier @schneierblog

Peter Singer @pwsinger

Frank Miller @FrankMillerInk

Kumail Nanjiani @kumailn

Jonah Ray @jonahray

Vint Cerf +vintcerf/posts

FOLLOW US @WIRED

DOWNLOAD

Get the digital edition of WIRED for your tablet at bit.ly/tabletWIRED.

PATRICK WITTY/WIRED; TV REVIEW: EMILY SHUR

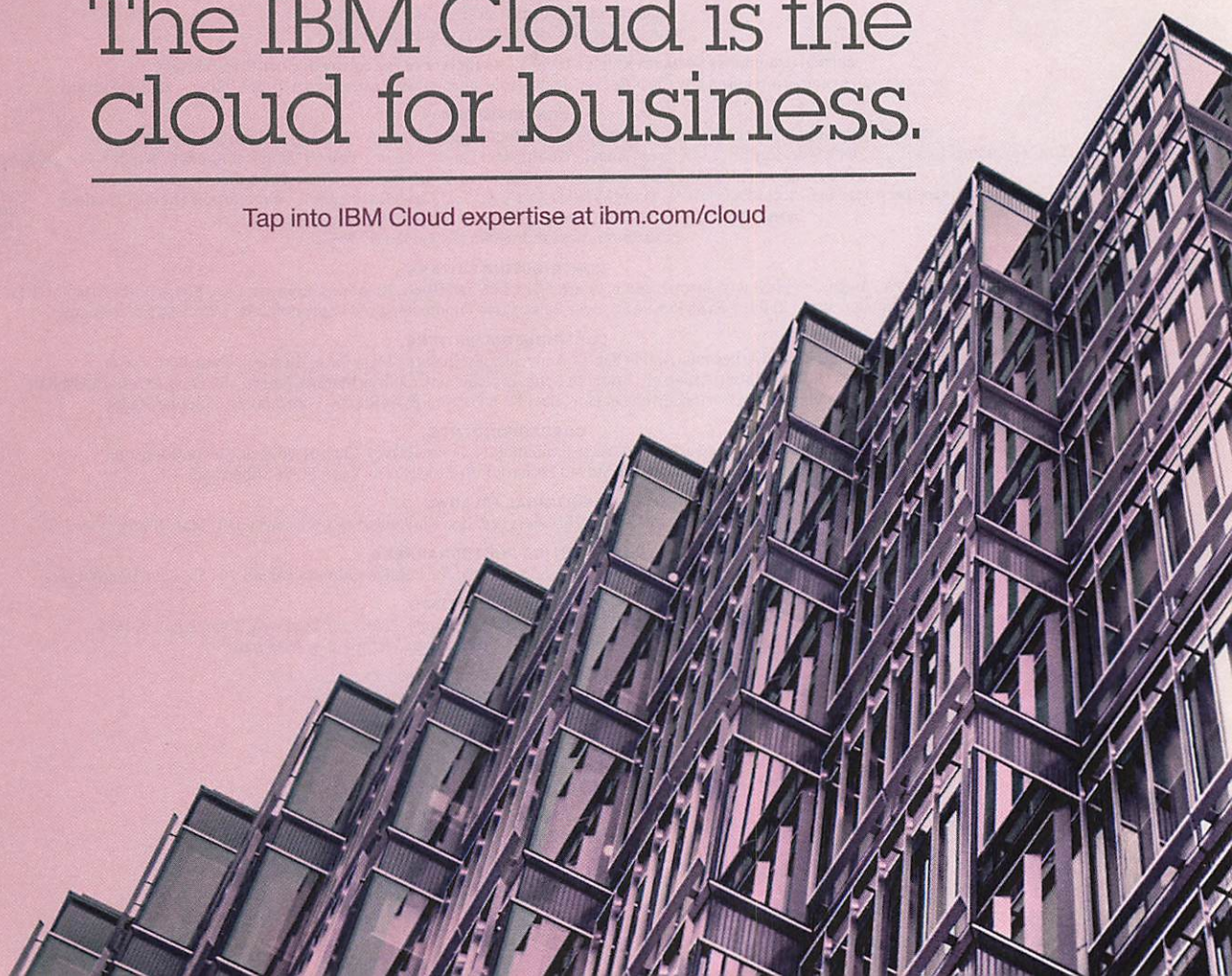
IS YOUR BUSINESS GETTING ENOUGH OUT OF THE CLOUD?

82% of enterprises aren't getting the most out of the cloud.

The IBM Cloud is engineered to help deliver on the demands of data-intensive businesses. It's built on dozens of data centers across five continents, featuring a private fiber network that helps protect data as it moves between them. It offers dedicated, bare metal servers to avoid interference from outside users. It features 100 ready-to-go SaaS solutions that deliver real business value. And it includes the support of 6,000 security consultants in 10 operations centers. No wonder 24 of the top 25 Fortune 500 companies choose the IBM Cloud. Business on the cloud is **made with IBM.**

The IBM Cloud is the cloud for business.

Tap into IBM Cloud expertise at ibm.com/cloud



82% stat sourced from RightScale 2014 State of the Cloud Report. IBM and its logo, ibm.com and made with IBM are trademarks of International Business Machines Corp. registered in many jurisdictions worldwide. See current list at ibm.com/trademark. ©International Business Machines Corp. 2014.

I REFRAIN FROM DIVULGING MY PERSONAL SECURITY MEASURES IN NATIONAL MAGAZINES.

LEAVING MY IPHONE IN PARIS!

EDITOR IN CHIEF Scott Dadich @sdadich

EXECUTIVE EDITOR Jason Tanz @jasontanz **MANAGING EDITOR** Jacob Young @jake65 **EDITOR, WIRED.COM** Mark McClusky @markmcc
CREATIVE DIRECTOR Billy Sorrentino @billysorrentino **DIRECTOR OF EDITORIAL PROJECTS** Robert Capps @robcapps

EDITORIAL

FEATURES EDITOR Mark Robinson @markrobsf **DEPUTY EDITOR** Joe Brown @joemfbrown **ARTICLES EDITORS** Cliff Kuang @cliffkuang, Adam Rogers @jetjocko
STORY EDITOR Chuck Squatriglia
DEPUTY MANAGING EDITORS Erica Jewell, Joanna Pearlstein @jopearl
SENIOR EDITORS Michael Calore @snackfight, Emily Dreyfuss (News and Opinion) @emilydreyfuss, Jon J. Eilenberg (Digital Editions) @jjeilenberg,
Sarah Fallon @sarahfallon, Betsy Mason @betsymason, Cade Metz, Susan Murcko @susanmurcko,
Caitlin Roper @caitlinroper, Peter Rubin @provenself
SENIOR STAFF WRITER Steven Levy @stevenlevy
COPY CHIEF Jennifer Prior @jhprior
COMMUNITY DIRECTOR Eric Steuer @ericsteuer **EDITORIAL OPERATIONS MANAGER** Jay Dayrit @jaydayhey
SENIOR ASSOCIATE EDITORS Bryan Gardiner, Kyle VanHemert
SENIOR WRITERS Mat Honan @mat, Robert McMillan @bobmcmillan, Greg Miller @cosmonos,
Ryan Tate @ryantate, Marcus Wohlsen @marcuswohlsen, Kim Zetter @kimzetter
ASSOCIATE EDITOR Alex Davies **STAFF WRITERS** Issie Lapowsky, Liz Stinson
SENIOR COPY EDITOR Brian Dustrud @dustrud **COPY EDITOR** Lee Simmons
ASSOCIATE RESEARCH EDITOR Cameron Bird @cbrrd **ASSISTANT RESEARCH EDITORS** Julia Greenberg @julia_greenberg,
Jason Kehe @jkehe, Katie M. Palmer @katiempalmer, Cory Perkins, Victoria Tang

ROLLER SHADES FROM THE ALAMEDA SHADE SHOP.

MY DOMAINS ARE REGISTERED TO THE ADDRESS OF A POPULAR SAN FRANCISCO PARK.

BOSS KEY FOREVER!

PASSWORDS BASED ON OBSCURE SHAKESPEARE CHARACTERS.

A POST-IT OVER MY WEBCAM.

DESIGN, PHOTO & VIDEO

DESIGN DIRECTOR Caleb Bennett **DIRECTOR OF PHOTOGRAPHY** Patrick Witty @patrickwitty
DESIGN DEVELOPMENT EDITOR Margaret Swart @meswart **SENIOR ART DIRECTOR** Dylan Boelte
SENIOR PHOTO EDITOR Anna Goldwater Alexander @annagoldwater
MANAGING ART DIRECTOR Victor Krummenacher @krummenacher **SENIOR PRODUCER** Sowjanya Kudva
POSTPRODUCTION SUPERVISOR Nurie Mohamed **ART DIRECTORS** Allie Fisher, Josef Reyes **PHOTO EDITOR** Paloma Shutes
ASSOCIATE ART DIRECTOR Rina Kushnir

TECHNOLOGY & PRODUCT

DIRECTOR OF PRODUCT MANAGEMENT Hayley Nelson @hayley_nelson
LEAD ENGINEER Kathleen Vignos @kathleencodes **WEB PRODUCER** Nicole Wilke **PROJECT MANAGER** Stephen McGarrigle
ENGINEERS Ben Chirlin, Ross Patton, Jorge A. Ruiz @muffnface, Jake Spurlock @whyisjake

PRIVATE BROWSING MODE ... FOR BUSINESS.

ARTISANAL FARADAY CAGE.

PRODUCTION

PRODUCTION DIRECTOR Ron Licata @ron_licata
PRODUCTION MANAGERS Myrna Chiu, Ryan Meith

EDITORIAL BUSINESS MANAGER Katelyn Davies **ASSOCIATE TO THE EDITOR IN CHIEF** Blanca Myers
INFORMATION SYSTEMS & TECHNOLOGY Chris Becker, Josh Strom @jadedfox **FACILITIES** Arthur Guiling **KP** Ron Ferrato

CONTRIBUTORS

EDITOR Chris Kohler @kobunheat **WRITERS** Christina Bonnington @redgirlsays, Adam Mann @adamspacemann,
Tim Moynihan @aperobot, Nick Stockton @stocktonsays, Angela Watercutter @waterslicer **DESIGN** Margaret Rhodes @callme_marge, Kelley Zerga
PHOTO Rosey Lakos, Julia Sabot @juliasabot, Josh Valcarcel @joshvalcarcel, Ariel Zambelich @azambelich
RESEARCH Jordan Crucchiola @jorcru, Timothy Lesle @telesle, Lexi Pandell @lpandell **PRODUCTION** Theresa Thadani
WEB PRODUCERS Samantha Oltman @samoltman, Matt Simon @mrmattsimon
COMMUNITY Alessandra Ram @alessandra_ram

NEVER DOING ANYTHING INTERESTING.

PIG LATIN: FOILING CODE BREAKERS ONE ORD-WAY AT A TIME.

CONTRIBUTING EDITORS

Mary H. K. Choi, Anil Dash, Joshua Davis, Jason Fagone, Charles Graeber, Jeff Howe, Brendan I. Koerner, Lone Shark Games, Daniel H. Pink,
Kevin Poulsen, Brian Raftery, Evan Ratliff, Spencer Reiss, Clive Thompson, Fred Vogelstein, Gary Wolf, David Wolman

I ALWAYS GIVE MY SOCIAL SECURITY NUMBER AS 867-5309.

CONTRIBUTING WRITERS

Rhett Allain, Samuel Arbesman, Aatish Bahtia, Andy Baio, Keith Barry, Mary Bates, Deborah Blum, Beth Carter,
Rachel Edidin, Laura Hudson, Christian Jarrett, Brandon Keim, Erik Klemetti, Jeffrey Marlow, Maryn McKenna, Graeme McMillan,
Doug Newcomb, Quinn Norton, Gwen Pearson, David S. F. Portree, Ryan Rigney, Lore Sjöberg, Philippe Starck

CORRESPONDENTS

Erin Biba, Paul Boutin, Stewart Brand, Mark Frauenfelder, Lucas Graves, Chris Hardwick, Steven Johnson,
Jonathon Keats, Brian Lam, Steven Leckart, Bob Parks, Frank Rose, Steve Silberman

EDITORIAL FELLOWS

Liana Bandziulis @lianabandz, Lydia Belanger @lydiabelanger, Brendan Klinkenberg, @brendan_klink, Max Ufberg @max_uf0

COMMUNICATING ONLY VIA CARRIER PIGEON.

CONTRIBUTING PHOTOGRAPHERS

Ian Allen, James Day, Christopher Griffith, Brent Humphreys, Platon, Joe Pugliese, Moises Saman, Art Streiber, Dan Winters

CONTRIBUTING ARTISTS

Brown Bird Design, Tavis Coburn, Carl de Torres, Gluekit, Mario Hugo, Erin Jang, Lamosca, Zohar Lazar, L-Dopa,
Jason Lee, Christoph Niemann, John Ritter, James Victore, Ben Wiseman

SENIOR DIRECTOR, COMMUNICATIONS Corey Wilson @coreypwilson
COORDINATOR, COMMUNICATIONS Danika Owsley @danikaowsley

SENIOR MAKER Chris Anderson
SENIOR MAVERICK Kevin Kelly
FOUNDING EDITOR Louis Rossetto

EDITORIAL DIRECTOR
Thomas J. Wallace

PLEASE RECYCLE THIS MAGAZINE

BY MOVING SIDE TO SIDE

SHAVING HAS FINALLY

MOVED FORWARD

Gillette

THE BEST A MAN CAN GET™

Fusion PROGLIDE

WITH FLEXBALL™ TECHNOLOGY

FUSION PROGLIDE REBUILT WITH NEW FLEXBALL TECHNOLOGY.

A razor that responds to every contour of your face for maximum contact* and gets virtually every hair.

*vs. Fusion ©2014 P&G

GILLETTE.COM

Howard S. Mittman
VICE PRESIDENT & PUBLISHER

Stefanie Rapp
ASSOCIATE PUBLISHER

Maya Draisin
ASSOCIATE PUBLISHER, MARKETING

Rory Stanton
DIRECTOR, FINANCE & BUSINESS OPERATIONS

Camille Signorelli
EXECUTIVE BRAND DIRECTOR

Melanie Altarescu
HEAD OF STRATEGIC INITIATIVES

Andrew Maiorana
GENERAL MANAGER, ADVERTISING

ERASING MY IDENTITY, *MEN IN BLACK* STYLE.

MY WI-FI UID IS "GUYS FROM QUANTICO." THEY CAN'T SPY ON THEIR OWN PEOPLE, RIGHT?

SENIOR DIRECTOR, MEDIA INNOVATIONS
Christopher Bower
SENIOR DIRECTOR, INTEGRATED SALES
Meghan Finnell
ACCOUNT DIRECTOR
Christine Kauffman
ACCOUNT MANAGERS
Tim Begley
Joanna Evans
Amanda Romano

DETROIT DIRECTOR
Stephanie Clement

LOS ANGELES DIRECTORS
Elizabeth M. Murphy
Alissa Heideman Spiwak

MIDWEST ACCOUNT DIRECTOR
Beth DeVillez
MIDWEST ACCOUNT MANAGER
Lindsay Clark

SOUTHEAST DIRECTOR
Dave Hady

SOUTHWEST REPRESENTATIVE
Julian R. Lowin

NORTHWEST DIRECTOR
Ashley R. Knowlton
NORTHWEST MANAGER
Kara L. Wardley

SENIOR PREMIUM MARKET MANAGER
Tracy Eisenman

PREMIUM MARKET MANAGER
Lauren M. Burkey

UK, IRELAND, NETHERLANDS & SWITZERLAND REPRESENTATIVE
David Simpson

FRANCE, GERMANY, SPAIN & PORTUGAL REPRESENTATIVE
Laurent Bouaziz

ITALY REPRESENTATIVE
Elena De Giuli

ASIA REPRESENTATIVE
Matthew Farrar

ASSISTANT GENERAL MANAGER, ADVERTISING
Susi Park

MANAGER, PLANNING & PRODUCT
Robbie Sauerberg
SENIOR DIGITAL PLANNERS
Charlotte Raimondi, Ed Sumner, Colin J. Weber
DIGITAL PLANNER
Ashley Tabroff

INTEGRATED MARKETING DIRECTOR
Michelle Meehan
SENIOR INTEGRATED MARKETING MANAGERS
Michael Assenza, Christopher Cona, Catherine Fish, Katherine Kirkland, Elena Mehas, Francesca Truffini

MARKETING DIRECTOR
Caitlin Rauch
ASSOCIATE MARKETING MANAGERS
Anna Chelak, Meagan Jordan
SENIOR MARKETING ASSOCIATE
Melissa Bickar
MARKETING ASSOCIATE
Nicole Riccardi

SENIOR ART DIRECTOR
Florence Pak
ASSOCIATE ART DIRECTOR
Mark Majdanski
SENIOR DESIGNER
Parker Bowab
MULTIMEDIA DESIGNER
Jessica Sander
SENIOR PRODUCER, MARKETING SOLUTIONS
Matthew Stevenson

DIRECTOR OF EVENTS & SPECIAL PROJECTS
Nagham Hilly
ASSOCIATE PROMOTIONS MANAGER
Kelsey Taylor
PROMOTIONS ASSOCIATE
Michelle Luis

SPECIAL PROJECTS MANAGER
Samantha Storch

BUSINESS MANAGER
Aubelia Oesman
BUSINESS ANALYST
Janelle Teng

ASSOCIATE TO THE PUBLISHER
Claire Caragol

ADVERTISING SALES ASSOCIATES
Saiba Arain, Patrick Brennan, Charlotte Cornett, Cherie Grimm, Nikki Korch, Sara Mack, Meghan McCarthy, Kathryn McNally, Martin Navarrete, Greg Pruett

MY TINDER PROFILE PICTURES ARE FROM TWO YEARS AGO. TAKE THAT, NSA!

1. WEAR A TIN FOIL HAT. 2. TURN COOKIES OFF.

I KEEP MY SHOTGUN AT THE READY FOR AERIAL DRONES.

LIVING PUBLICLY!

FOR ADVERTISING OPPORTUNITIES, PLEASE CALL (212) 286 3868.
FOR IDEAS, EVENTS, AND PROMOTIONS, FOLLOW @WIREDINSIDER OR VISIT WIREDINSIDER.COM.

PUBLISHED BY CONDÉ NAST

CHAIRMAN S. I. Newhouse, Jr.
CHIEF EXECUTIVE OFFICER Charles H. Townsend
PRESIDENT Robert A. Sauerberg, Jr.
CHIEF OPERATING OFFICER/CHIEF FINANCIAL OFFICER John W. Bellando
PRESIDENT, CONDÉ NAST MEDIA GROUP & CHIEF REVENUE OFFICER Louis Cona
CHIEF ADMINISTRATIVE OFFICER Jill Bright
CHIEF TECHNOLOGY OFFICER Joe Simon

EXECUTIVE VICE PRESIDENT/ CHIEF INTEGRATION OFFICER Drew Schutte
SENIOR VICE PRESIDENT, OPERATIONS & STRATEGIC SOURCING David Orlin
MANAGING DIRECTOR, REAL ESTATE Robert Bennis
SENIOR VICE PRESIDENT/CORPORATE CONTROLLER David B. Chemidlin
SENIOR VICE PRESIDENT, MARKET RESEARCH Scott McDonald
SENIOR VICE PRESIDENT, FINANCE Jennifer Graham
SENIOR VICE PRESIDENT, BUSINESS DEVELOPMENT Julie Michalowski
SENIOR VICE PRESIDENT, EDITORIAL OPERATIONS Rick Levine
SENIOR VICE PRESIDENT, HUMAN RESOURCES JoAnn Murray
SENIOR VICE PRESIDENT, DIGITAL TECHNOLOGY Nick Rockwell
SENIOR VICE PRESIDENT, CORPORATE COMMUNICATIONS Patricia Röckenwagner
SENIOR VICE PRESIDENT, EDITORIAL ASSETS & RIGHTS Edward Klaris
VICE PRESIDENT, CN LICENSING John Kulhawik
VICE PRESIDENT, MANUFACTURING Gena Kelly
VICE PRESIDENT, STRATEGIC SOURCING Tony Turner
VICE PRESIDENT, PLANNING & STRATEGY Shen-Hsin Hung
VICE PRESIDENT, DIGITAL PRODUCT DEVELOPMENT Chris Jones
VICE PRESIDENT, HUMAN RESOURCES Nicole Zussman
VICE PRESIDENT, SPECIAL PROJECTS Patty Newburger
VICE PRESIDENT, DIGITAL OPERATIONS & MONETIZATION Christopher Guenther
VICE PRESIDENT, CORPORATE COMMUNICATIONS Joseph Libonati

CONDÉ NAST MEDIA GROUP
VICE PRESIDENT, CORPORATE PARTNERSHIPS Josh Stinchcomb
VICE PRESIDENT, INSIGHT & BRAND STRATEGY Daniella Wells
VICE PRESIDENT, MARKETING SOLUTIONS Padraig Connolly
VICE PRESIDENT, FINANCE Judy Safir
CONDÉ NAST CONSUMER MARKETING EXECUTIVE VICE PRESIDENT Monica Ray
VICE PRESIDENT, CONSUMER MARKETING Gary Foodim
VICE PRESIDENT, PLANNING & OPERATIONS Matthew Hoffmeyer
VICE PRESIDENT, CONSUMER MARKETING PROMOTION Gina Simmons
VICE PRESIDENT, MARKETING ANALYTICS Christopher Reynolds
CONDÉ NAST ENTERTAINMENT PRESIDENT Dawn Ostroff
EXECUTIVE VICE PRESIDENT/CHIEF OPERATING OFFICER Sahar Elhabashi
EXECUTIVE VICE PRESIDENT, MOTION PICTURES Jeremy Steckler
EXECUTIVE VICE PRESIDENT, PROGRAMMING & CONTENT STRATEGY, DIGITAL CHANNELS Michael Klein
EXECUTIVE VICE PRESIDENT/CHIEF DIGITAL OFFICER Fred Santarpia
EXECUTIVE VICE PRESIDENT/ALTERNATIVE TV Joe LaBracio
CHIEF REVENUE OFFICER Lisa Valentino
SENIOR VICE PRESIDENT, BUSINESS DEVELOPMENT & STRATEGY Whitney Howard
VICE PRESIDENT, DIGITAL VIDEO OPERATIONS Larry Baach
VICE PRESIDENT, TECHNOLOGY Marvin Li
VICE PRESIDENT, REVENUE OPERATIONS Jason Baird
VICE PRESIDENT, MARKETING Mei Lee
VICE PRESIDENT, PRODUCTION Jed Weintrob
VICE PRESIDENT, SCRIPTED TV Gina Marcheschi
VICE PRESIDENT, BRANDED CONTENT & SALES MARKETING Anissa E. Frey

TO SUBSCRIBE OR ORDER BACK ISSUES
EMAIL *subscriptions@wired.com* CALL (800) 50 WIRED inside the US, +1 515 243 3273 outside the US MAIL WIRED, PO Box 37706, Boone, IA 50037-0706.
Foreign subscriptions payable by credit card, postal money order in US dollars, or check drawn on a US bank. SUBSCRIPTION CUSTOMER SERVICE *www.wired.com*
REUSE PERMISSIONS *permissions@condenast.com* or (800) 897 8666 REPRINTS *reprints@condenast.com* or (800) 501 9571, ext. 100
ADDRESS WIRED, 520 Third Street, Ste. 305, San Francisco, CA 94107-1815 PHONE (415) 276 5000 EMAIL *mail@wired.com* (letters); *submitpr@wired.com* (pitches)

Copyright ©2014 by Condé Nast. All rights reserved. Reproduction without permission is prohibited.
WIRED (ISSN 1059-1028) is a publication of Condé Nast, a subsidiary of Advance Publications Inc. PRINTED IN THE USA. ABC Audited

WHEN WE ALL
COME TOGETHER
CANCER DOESN'T STAND
A CHANCE

FRIDAY, SEPT 5th
8PM / 7 CENTRAL

THE STARS WILL ALIGN

GO TO STANDUP2CANCER.ORG

CANADIAN BREAST CANCER FOUNDATION, CANADIAN CANCER SOCIETY, CANADIAN INSTITUTES OF HEALTH RESEARCH, CANCER RESEARCH INSTITUTE, CANCER STEM CELL CONSORTIUM, FARRAH FAWCETT FOUNDATION, FIFTH THIRD BANK, FOX FAMILY CANCER RESEARCH FUNDING TRUST, GENOME CANADA, LAURA ZISKIN FAMILY TRUST, LUSTGARTEN FOUNDATION, MELANOMA RESEARCH ALLIANCE, NATIONAL OVARIAN CANCER COALITION, ONTARIO INSTITUTE FOR CANCER RESEARCH, OVARIAN CANCER NATIONAL ALLIANCE, OVARIAN CANCER RESEARCH FUND, ROOMKEY.COM, SEAN PARKER FOUNDATION, SIEMENS, ST. BALDRICK'S FOUNDATION

STAND UP TO CANCER IS A PROGRAM OF THE ENTERTAINMENT INDUSTRY FOUNDATION (EIF), A 501(C)(3) CHARITABLE ORGANIZATION. IMAGES FROM THE STAND UP TO CANCER 2012 SHOW. THE AMERICAN ASSOCIATION FOR CANCER RESEARCH (AACR) IS STAND UP TO CANCER'S SCIENTIFIC PARTNER.

It took nearly a year of work before we finally had our first meeting with Snowden (left).

I **WAS IN A RUSSIAN** hotel room, waiting for the biggest photo shoot of my life. My suite's blackout curtains were drawn, the better to conceal the several hundred thousand dollars worth of high-powered lighting and gear we had brought with us. I sat very still; next to me, Platon, one of the world's most accomplished and respected photographers, paced back and forth. Patrick Witty, WIRED's director of photography, stood near the doorway, looking through the peephole at the empty hall. Reflexively, I reached into my left pants pocket for my iPhone, but it wasn't there. For half a second, my heart fluttered, but then I remembered that I had left the phone at home so it couldn't be tapped. For the purposes of this trip, I only had an 800-ruble burner, now sitting quietly on the hotel nightstand, its Cyrillic menu unintelligible to me. ¶ Just a few people on earth knew where I was and why—in Moscow, to sit down with Edward Snowden. It was a secret that required great efforts to keep. I told coworkers and friends that I was traveling to Paris, for "some work." But the harder part was covering my digital tracks. Snowden himself had shown how illusory our assumption of privacy really is, a lesson we took to heart. That meant avoiding smartphones, encrypting files, holding secret meetings. ¶ It took nearly a year of work and many months of negotiation to win Snowden's cooperation. Now the first meeting was just minutes away. I've led a lot of cover shoots in my 20 years in magazines: presidents, celebrities, people I've admired, and people I've reviled. Cowboys and stateswomen. Architects and heroes. But I'd never felt pressure like this. ¶ At 12:15 pm, Snowden knocked on the door of our suite. He had done his homework; he knew Patrick's title before he had a chance to introduce himself. We motioned for him to join us over on the couch,

Available at Macy's and macys.com

and I took a seat in an armchair to his left. After the introductions ("Call me Ed") and a few pleasantries, Platon asked him the question I know we were all thinking: "How are you doing?" It quickly became clear that, as nervous as we all were, Snowden was completely at ease. He described, in vivid detail, how he was feeling, what his days were like. He talked politics and policy, constitutional law, governmental regulation, and personal privacy. He said he was really glad to see us—Americans—and he said he was homesick. He held forth for nearly an hour, meandering from subject to subject but always precise in his vocabulary—quoting statutes and bill numbers, CIA regulations and actions, with what seemed to be total recall.

Eventually we moved into what had been the formal dining room. Platon asked Snowden to sit down on an apple box, a small wooden crate that he had used in his shoots of nearly every world leader alive today, including Vladimir Putin and Barack Obama. Platon squatted in front of his subject, as he often does, making himself small and unthreatening. He explained his process very slowly and told Snowden that he'd be asking him to reveal his innermost feelings for the camera. I moved to the back of the room and took in the scene as Platon began to shoot. The two men experimented with a number of poses, angles, and postures, and nearly an hour into shooting it was clear that Snowden was enjoying the process.

SNOWDEN HELD THE FLAG IN HIS HANDS AND DELICATELY UNFOLDED IT. YOU COULD SEE THE GEARS TURNING.

Back in New York, Platon had done some shopping at a little bodega near his studio. Now he pulled out a knotted plastic bag with his finds: a black T-shirt with the word SECURITY emblazoned in all-caps on both the front and back; another black T, featuring a giant, screaming eagle with flared talons beneath a patriotic slogan; giant red and blue poster markers; an unlined notepad; American flag patches; and an American flag (actually, the same flag brandished by Pamela Anderson in Platon's iconic 1998 *George* magazine cover). Platon spread the items out on the table and asked Snowden if any of the props resonated with him. Snowden laughed and picked up the SECURITY T-shirt. "That's funny," he said. "I think it would be fun to wear that." He went into the bathroom and changed into the shirt, and when he emerged he had his chest puffed out a bit, enjoying the joke of it. We all laughed and Platon shot a few rolls of film.

We returned to the prop table, and Snowden picked up the flag. Platon asked him what he'd do with it in a picture. Snowden held the flag in his hands and delicately unfolded it. You could see the gears turning as he weighed his year in exile against the love of country that motivated him in the first place. He said he was nervous that posing with the flag might anger people but that it meant a lot to him. He said that he loved his country. He cradled the flag and held it close to his heart. Nobody said a word, and the hairs on the back of my neck stood up. We all sat there for a long moment, studying him. Then Platon yelled, *"Don't move!"* He clicked off frame after frame, making tiny adjustments to both the lighting and Snowden's posture, sometimes asking for him to look into the lens, sometimes just above it. We had our cover.

After that, there wasn't much else to do. We sat and talked a bit more. Snowden said he didn't really have anyplace to be, but I could tell the shoot had worn him out—and with good reason. Including a short lunch break, we'd been going for four hours. At that very moment our writer, James Bamford, was on a plane bound for Moscow; he and Snowden would meet a few days later and talk over the course of three more days.

It was time to go. Platon had brought a copy of each of his two books as a gift. Snowden asked for an inscription, and I snapped a picture of the moment. We shook hands, each of us wishing the other luck as we gathered in the foyer. "I hope our paths cross again someday," Platon said. "I hope I get to see you back at home, in the US." Snowden looked straight at him as he threw his backpack over his shoulder and said, "You probably won't." With that, he closed the door and was gone.

SCOTT DADICH
Editor in Chief

TONIGHT WE
Tanqueray®
Tanqueray
IMPORTED
LONDON DRY GIN
CHECK OUT RAVAUGHN'S STORY AT FACEBOOK.COM/TANQUERAY
PLEASE DRINK RESPONSIBLY.
TANQUERAY LONDON DRY GIN. 100% GRAIN NEUTRAL SPIRITS. 47.3% ALC/VOL. ©2014 IMPORTED BY CHARLES TANQUERAY & CO., NORWALK, CT.

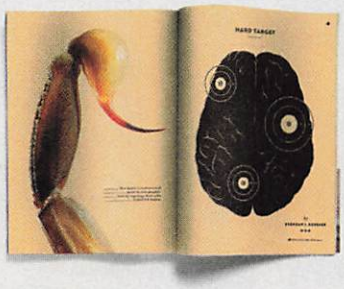
CHARM OFFENSIVE

In an era of wearable computers, hook-up apps, and e-cigarettes, the rules of comportment aren't always self-evident. So for July's advice package, "The Code: A WIRED Guide to Behavior, Manners, and Style," we asked comedian Jerry Seinfeld to serve as our modern etiquette consultant. His answers took us by surprise. Spying on the neighbor's cat with a drone? Fine. Movie spoilers? Fine. But we're going to have to put the ix-nay on wearing Google Glass to a bar. Come on.

"HARD TARGET": USING SCORPION VENOM TO HIGHLIGHT BRAIN TUMORS

"DISTURBING THAT THE HUMAN BRAIN HAS THE CONSISTENCY OF A 'WOBBLY SLAB OF JELL-O.'"

Ivor Tossell (@ivortossell) on Twitter



"HARD TARGET"

"I planned to let my subscription lapse. But I then I read the article about an attempt to use scorpion venom to track cancer cells in the brain. My husband died of brain cancer nearly two years ago. What Jim Olson is doing is a big step in the right direction. Thank you, Dr. Olson, for bringing hope. I'm renewing our WIRED subscription in my husband's honor."

Carole McLeod, via email

"GROUND WAR": COMPANIES VIE FOR SAME-DAY DELIVERY DOMINANCE

"Operating a fleet of trucks 12 hours a day, spewing CO and CO_2 continuously, just to encourage 'whim' shopping? Sounds like a crime in the name of convenience. By the way, keep your damn robots out of my refrigerator!"

Paul Dirks on WIRED.com

"THE CODE"

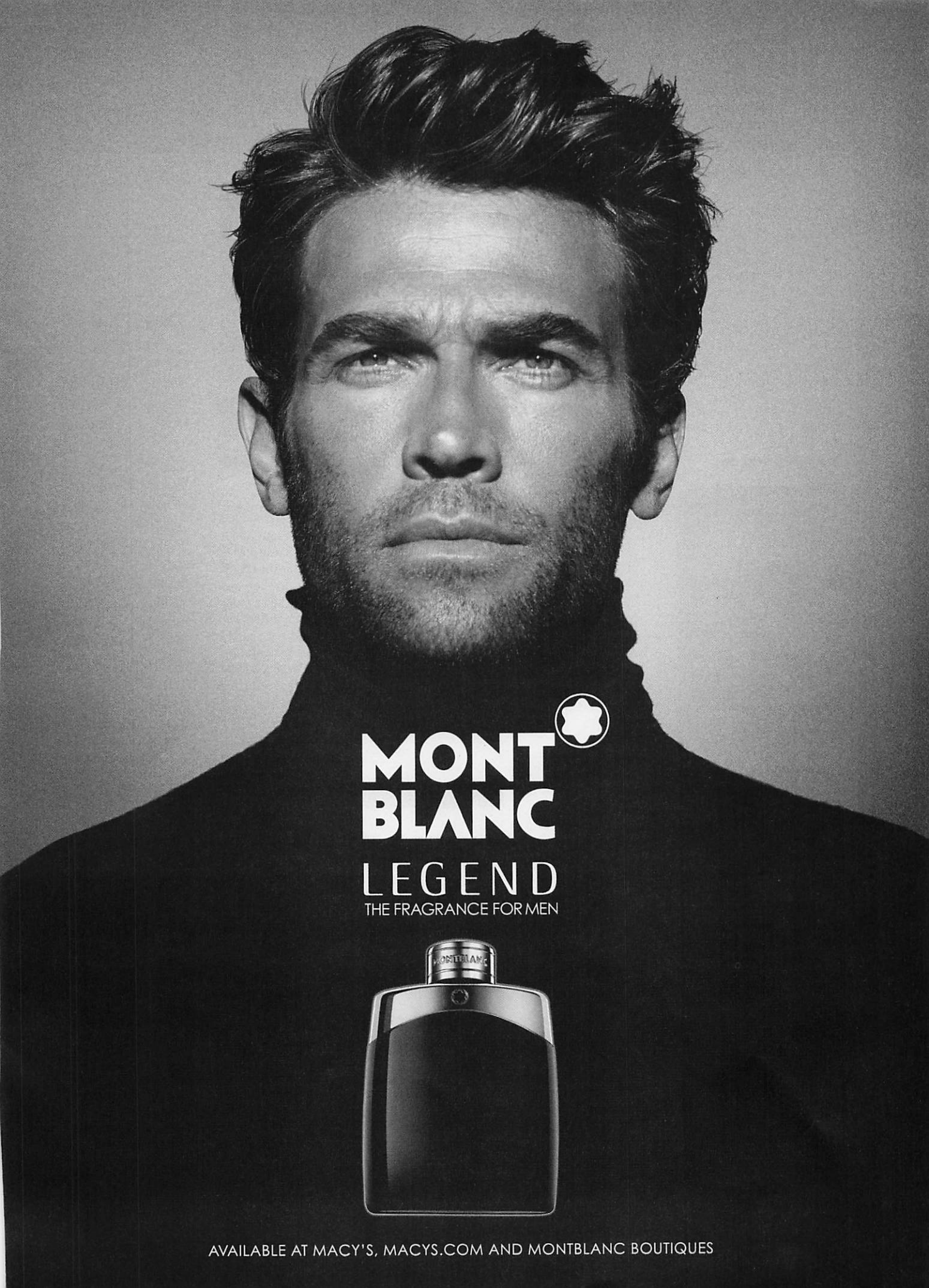
"While I thoroughly enjoyed your feature with Jerry Seinfeld, I have to argue that *The Daily Show*'s Jason Jones (below) looked much cooler in his homemade Glasshole headgear—disposable camera, iPhone, alligator clip—in our June 12 episode."

Miles Kahn, senior producer at *The Daily Show With Jon Stewart*, via email

"Walt Whitman supposedly said, 'If you done it, it ain't bragging.' He was wrong. Writer Elise Craig is right to suggest that we should lose the false humility when boasting, as in 'I'm sorry I can't join you; I will be hosting Quentin Tarantino and Charlize Theron at my Aspen ranch.' There's no amount of tenderizing that can completely root out hubris."

Charlie Haviland via email

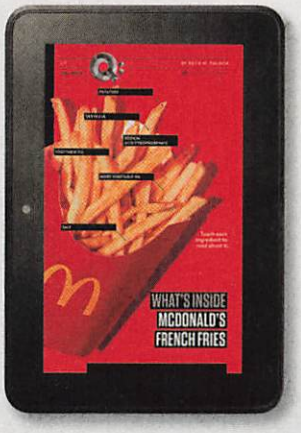
COURTESY OF COMEDY CENTRAL

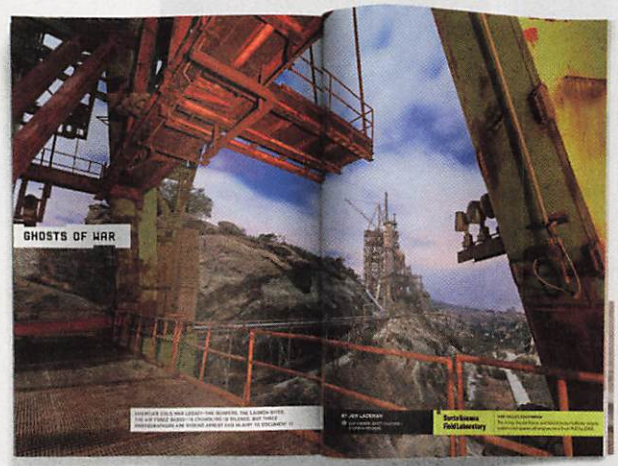

MONT BLANC
LEGEND
THE FRAGRANCE FOR MEN
AVAILABLE AT MACY'S, MACYS.COM AND MONTBLANC BOUTIQUES

"WHAT'S INSIDE": MCDONALD'S FRENCH FRIES

"Maybe McDonald's should go back to cooking with beef tallow. There doesn't seem to be a lot of evidence that tallow and lard are actually any worse for you than the vegetable oils that replaced them."

artinvent on WIRED.com





"GHOSTS OF WAR": PHOTOGRAPHERS DOCUMENT CRUMBLING MILITARY RELICS

"Let's not pretend this is really about the noble goal of documenting these places before they disappear. I worked for the US Air Force and our cultural resources division was tasked with this very thing. We had a radar installation in Alaska slated for demolition, but since it was from the Cold War era, we had to send a team to photograph it. Documentation complete, demolition could proceed. Maybe these folks could get the contract to do this for the government in an official way ... but admittedly that's not as much fun. :)"

Jeff on WIRED.com

"GHOSTS OF WAR"

"The government should be paying photographers Jon Haeber, Scott Haefner, and Stephen Freskos for their work. Someday the people who have reason to hide these Cold War installations will be gone. We need to give future historians something to work with."

Gerard Hebert via email

"THE WILD BUNCH": FINDING FRESH EDIBLES IN NATURE'S CUPBOARD

"In late spring, milkweed shoots up out of the ground practically everywhere here in New York. Before it flowers, it is a very tasty and plentiful edible. It tastes like a cross between asparagus and green beans. Just clip off the top, including a portion of the stem and two leaves. Boil. Serve with butter, salt, and lemon juice."

Nopesauce on WIRED.com

"Why do we eat so little of Earth's edible stash? Very good piece by Hillary Rosner on expanding our agricultural horizons."

Azeen Ghorayshi (@azeen_g) on Twitter

"SPACE CHASE": HOW TO COLLIDE WITH A COMET

"YOU KNOW YOU CAN'T LITERALLY HITCH YOUR WAGON TO A SHOOTING STAR, RIGHT?"

Ken Lizzi (@kenlizzi) on Twitter

"GADGET LAB EXPEDITION": SOLO-CANOEING WITH CUTTING-EDGE GEAR

"There's no such thing as a 'bear-proof' cooler. Here in Alaska, where we've got both black bears and grizzlies roaming our neighborhoods on trash day, we use the term 'bear-resistant' for our bins. Federal agencies use the same language for the food containers required at many backcountry locations throughout the US."

Skeptic on WIRED.com

"EXPEDITION": RIDING THROUGH THE FOREST

"Just what the great Cascades need: more noisy motorcycles. Please, ride on the pavement to the edge of wonderful, park your bike, and walk into the mountains—silently. Keep it the way it was before you rode in."

oregon_man on WIRED.com

HOTELS THAT TAKE YOUR BREATH AWAY
MORE FREE NIGHTS TO CATCH IT

5X POINTS

JW Marriott® Phoenix Desert Ridge Resort & Spa, Arizona
Marriott Rewards® Category 8

5 POINTS PER $1 SPENT AT 3,800 MARRIOTT® LOCATIONS WORLDWIDE
FROM LUXURY HOTELS TO GOLF RESORTS

STAYING POWER™

The Marriott Rewards Premier Credit Card · MarriottPremier.com APPLY TODAY

Accounts subject to credit approval. Restrictions and limitations apply. Marriott Rewards credit cards are issued by Chase Bank USA, N.A. Offer subject to change. See MarriottPremier.com for pricing and rewards details. Marriott Rewards points needed for a standard reward free night stay range from 7,500 points for Category 1 hotels to 45,000 points for Category 9 hotels. Refer to MarriottRewards.com for all reward redemption values.
© 2014 JPMorgan Chase & Co. All rights reserved.

DELL

This laptop got lost and nothing happened.

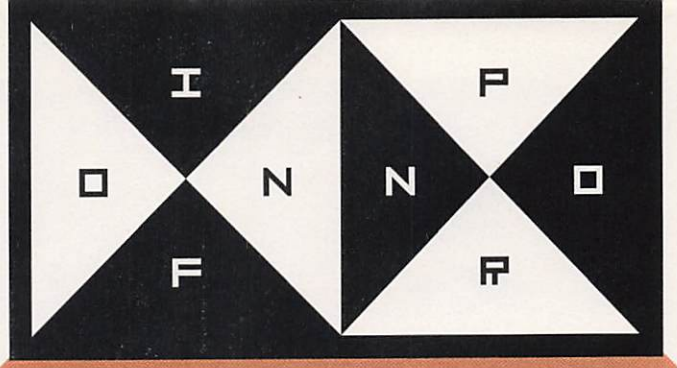
When almost a quarter of security breaches are caused by lost or stolen devices, choosing the right technology partners becomes a critical business decision. When you have Dell laptops with Intel® Core™ vPro™ processors, the most secure commercial PCs on the market, it's a decision you never have to think twice about. Just like that laptop.

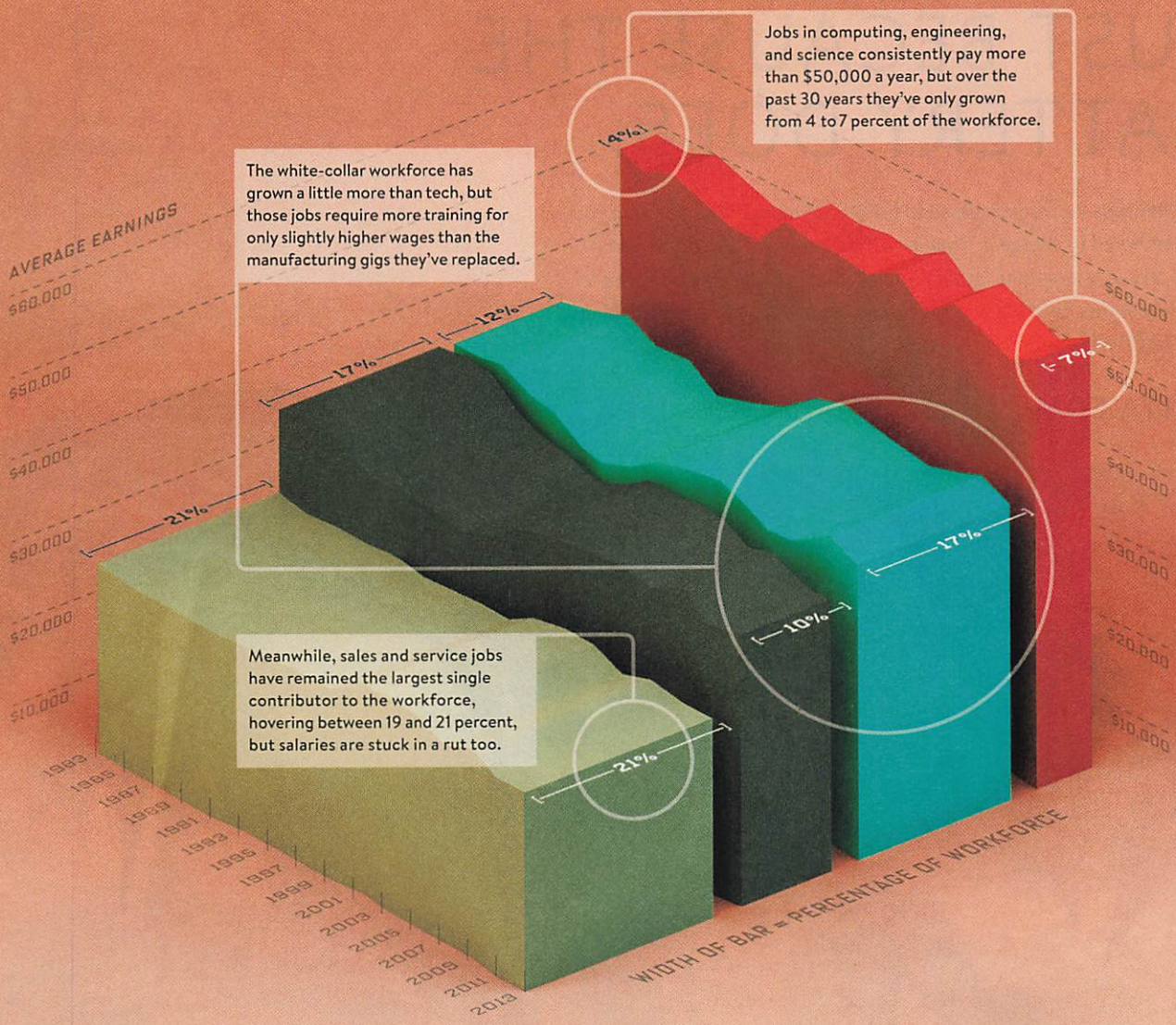
Better technology is better business

Dell.com/betterbusiness

intel inside CORE™ i5 vPro™

Intel, the Intel logo, Intel Core, Intel vPro, Core Inside and vPro Inside are trademarks of Intel Corporation in the U.S. and/or other countries.
©2014 Dell Inc. All rights reserved. Dell, the Dell logo, and the Dell badge are trademarks of Dell Inc.





HARD WORK

Tech jobs pay—if only there were more of them.

Labor Day used to celebrate physical labor, the sawing and smelting that built up the US economy. But now the robots have taken over that sweaty work, and we've turned ourselves into sleek knowledge workers in the all-new Internet economy. Well, some of us at least. High-skill jobs in engineering and technology are the best-paid around, but as a share of the workforce their numbers have barely grown—from 4 percent at the dawn of the computer age to a measly 7 percent today. Meanwhile, the staples of our economy, manufacturing and service, continue to stagnate or decline. So while everyone benefits a little from tech-enabled, en-cheapened services like Uber and Airbnb, it's still only a select few who reap the rewards of the digital age. —ALLISON SCHRAGER

Technology
White-collar
Manufacturing
Sales

SOURCES: NATIONAL BUREAU OF ECONOMIC RESEARCH (OR NBER); CURRENT POPULATION SURVEY; ALLISON SCHRAGER. FULL LIST OF CONTRIBUTORS: WIRED.COM\SOURCES

KEEP CLIMBING

DELTA

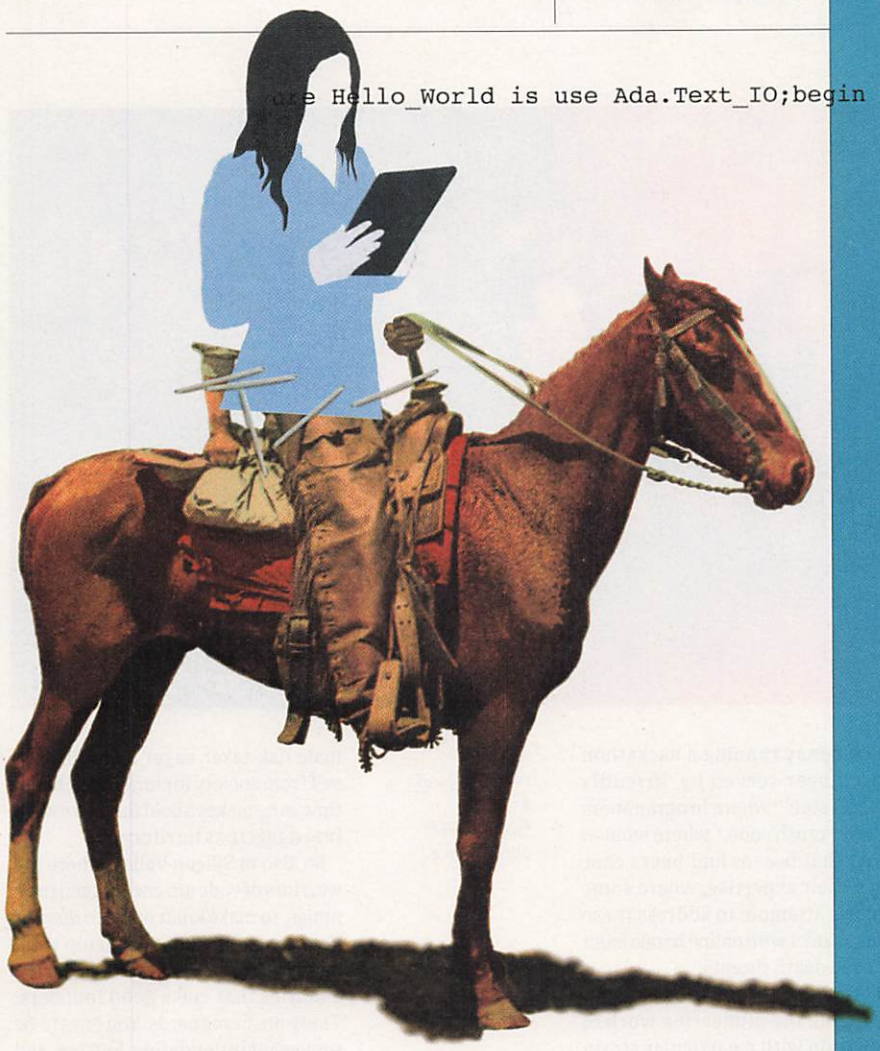
WORK DOESN'T STOP JUST BECAUSE THE BATTERY DOES.

Just because you remembered to bring your phone doesn't mean you remembered to charge it. That's why we've put a USB port at every seat on every long-haul international flight, so it can stay powered for the whole trip. Because when it comes to power, why let a little thing like 30,000 feet stand in the way?

DELTA.COM

FORTUNE and The World's Most Admired Companies are registered trademarks of Time Inc. and are used under license. FORTUNE and Time Inc. are not affiliated with, and do not endorse products or services of, Delta Air Lines. USB cords not included.

BY VIKRAM CHANDRA



OF PHILOSOPHERS AND PIONEERS

THE MYTHS OF SILICON VALLEY

SILICON VALLEY HAS BEEN wracked with controversies about sexism lately. Only 17 percent of Google's technical employees are women. Tech conference organizers routinely post speaker lists that skew male. The female cofounder of Tinder was allegedly harassed and erased from corporate history last year. Yet some people still minimize the problem. Their argument: Since the tech industry is populated by meritocratic rationalists, it would be impossible for a talented female engineer *not* to rise

MATT DORFMAN

HORSE: LIBRARY OF CONGRESS, PRINTS AND PHOTOGRAPHS DIVISION, PHOTOCHROM COLLECTION, LC-DIG-PPMSCA-17855

to the top. Therefore, if few women are in the industry, the problem is not sexism but the absence of some innate capacity or interest on the part of (most) women. In other words, the dearth of women in tech is only natural.

Having grown up in India and worked as a coder in the US, I find this line of reasoning specious. One of the characters in *Love and Longing in Bombay*, a collection of short stories I published in 1997, is a young female programmer who founds and runs a company out of her apartment. This fictional depiction grew out of a decidedly nonfictional reality: I had noticed many such women in India, and over the years their numbers have increased steadily. The proportion of programmers in India who are women is at least 30 percent. In the US it's 21 percent.

And this despite the fact that by most indexes—economic opportunity, educational attainment, health—women in India have access to a narrower set of opportunities than women in the United States. So unless nature is working contrarily in South Asia, something about the culture of the Indian educational system and tech industry is more hospitable to women than the American one. If we can figure out what that difference is, we can begin to change things for the better in the US.

IN INDIA, women feel at home in engineering. One 2013 study of Indian engineering students asked whether they ever felt left out in an academic setting. About 8 percent of female engineers reported such feelings, while almost 20 percent of male engineers sometimes felt left out. In another study, female students described the culture of computing as one that prizes meticulousness, intelligence, sociability, and mutual assistance. In workplace interviews with both sexes, sociologist Winifred Poster found "a pervasive conviction that women and men have similar mental abilities to do technical work" and so "an assumption that *technical work itself has no gender*."

In the US, the culture of tech definitely has a gender. It's a culture where one company running a hackathon offered beer served by "friendly (female) staff," where brogrammers proudly "crush code," where women report that bosses and peers challeng e their expertise, where some women's attempts to address these issues are met with online harassment and even death threats.

Of course, the US has a long history of infusing the pioneering work of innovation with a particular strain of masculinity. In the popular imagination, the rugged, well-armed pioneer was a de facto soldier of Manifest Destiny, a resourceful problem solver, a man of action. And in 1910, with the westward expansion completed, Frederick Jackson Turner argued that the nation must turn to a new, figurative wilderness, the frontier of knowledge, and that scientists must lead: "The test tube and the microscope are needed rather than the ax and rifle in this new ideal of conquest." In a prideful 1930 evocation of American exceptionalism, botanist and mathematician J. Arthur Harris observed, "In Europe they cross the frontier. In America we penetrate the frontier." The contributions of women notwithstanding, the imagined, mythologized pioneer becomes unmistakably male. Leah Ceccarelli, a scholar of rhetoric, points out that in the US "the archetype of the frontier explorer to which scientists are invariably compared is a white male risk-taker, eager to isolate himself from society for long stretches of time as he makes a bold thrust forward into dangerous territory."

A sea of male faces at a recent Google I/O conference.

So also in Silicon Valley, where the warriors of code are encouraged to be ninjas, to make killer apps, to *disrupt*. Venture capitalist and startup whisperer Paul Graham knows on sight the qualities that make good founders: "These are fierce nerds. You have to be somewhat intimidating-looking, and that's what these guys are," he said in a 2012 NPR interview. "They're like the kind of people Julius Caesar was afraid of." And if women don't look lean and hungry and dangerous enough, well, that's just nature at work.

BUT THERE ARE other ways to imagine the qualities necessary to succeed as an engineer and scientific thinker. In the Indian context, debate has always been—in philosopher B. K. Matilal's words—the "preferred form of rationality." The earliest extant Indian texts, the Vedas, contain many hymns conceived as questions and answers or discussions. The *Bhagavad Gita* is staged as a dialog. Scientific and philosophical texts were often written in the sutra form, collections of tightly economical aphorisms in verse; the important ones were always surrounded by commentaries, and commentaries on commentaries. As the famous saying had it, "*Vāde*

VIKRAM CHANDRA (www.vikramchandra.com) is *a novelist and the author of* Geek Sublime, *to be published in September by Graywolf Press.*

JAMES MERITHEW

INTRODUCING

fire PHONE

THE FIRST SMARTPHONE DESIGNED BY AMAZON

amazon

Exclusively on at&t

FIREFLY TECHNOLOGY

Simply press the Firefly button to quickly identify phone numbers, web addresses, and over 100 million items—including movies, TV episodes, songs, and products.

DYNAMIC PERSPECTIVE

Dive into a new class of immersive apps and games. Tilt, auto-scroll, swivel, and peek to navigate menus and access shortcuts with one hand.

LIMITED-TIME OFFER
INCLUDES A FULL YEAR OF PRIME

Enjoy 40,000 movies and TV episodes, over a million songs, 500,000 books to borrow, and FREE 2-day shipping on millions of items. Restrictions apply. See amazon.com/fireoffer for details.

vāde jāyate tattvabodhaḥ" ("In continuous dialogue emerges knowing of the essence"). Great halls were built for the sole purpose of debate. Women occasionally participated, but the culture was a masculine one.

The modern equivalent of such dialog, however, actively recognizes women's scientific and technical skills: In a 2004 study, anthropologist Carol Mukhopadhyay reported that when she asked Indian interviewees to react to the idea that mathematics is inherently masculine, their response was "surprise, laughter, and bewilderment"; they countered with stories of female mathematicians in Indian history. Another study, from 2007, notes that "almost all IT professionals in Chennai, male and female, insisted to us that both sexes have equal technical skills ... and, in relation to gender, the Indian IT industry contrasts with its counterparts in Europe and America." The middle-class consensus is: If women want to program, and if this is now socially acceptable, of course they can and should.

But in the United States, which imagines pioneers as male combatants, can men realize that sometimes a microscope is just a microscope and still remain pioneers? US programmers, like coders everywhere, work in teams, but they seem imaginatively committed to the ideal of the violent, lonely frontiersman. The resistance to the introduction of women into the cowboy posse springs, I think, from fear that the very nature of the activity will be transformed, that men will have to adopt (supposedly) female ways of working. The action will move from the mesa to the parlor. The lone warriors will be domesticated, forced to be effetely polite. They will become mere conversationalists, doing something that looks less like penetration and more like the knitting of a vast skein. The would-be riflemen and dagger-wielders will be *unmanned.*

To be sure, there is no lack of violence and warrior machismo in the Indian tradition, and those cultural elements still rule much of the landscape outside of the debate halls and technology parks. Though the IT environment is largely gender-neutral and is attractive to women precisely because it functions as a haven from some of the misogyny outside, it's far from perfect: In a study by Poster, women reported impediments to full participation, especially at managerial levels—social conventions and safety concerns limit work hours and travel. Meanwhile, more women in the US achieve management positions than in India, and they receive fairer wages in these nontechnical roles.

According to Poster, one Indian subsidiary of a US tech company mixed elements from both cultures: flex time, open-floor seating plans, and freer gender mixing from the US, with family benefits from India, including three months of maternity leave and allowances for domestic help. A female employee responded enthusiastically: "It is the most beautiful thing I have ever seen ... It is quite different from other Indian companies. It is quite different from other multinationals. *It has a total freedom.*" But the women also noted that American managers unconsciously imported their engineering culture, so that suddenly the women were facing supervisors who questioned their engineering skills, trivialized their technical aptitude, and overlooked their contributions.

THE LONE WARRIOR WILL BECOME DOMESTICATED, FORCED TO BE POLITE. THE WOULD-BE DAGGER-WIELDERS AND RIFLEMEN WILL BE UNMANNED.

Can the virtues of a blended freedom—American-style flexibility and social fluidity with Indian-style familial support and recognition of women's engineering skills—be replicated on a wide scale? Maybe. The first step to checking this culture of blithe sexism and systematic exclusion masquerading as a meritocracy is to recognize that it is rooted in a mythology. Myths are energizing, but they can also blind us to the received notions that shape how we see the world. The frontier myth of Silicon Valley traps men in a hall of mirrors, where all they can see is go-it-alone gunslingers. Once we recognize this, we can start to tell ourselves newer, better stories. W

JARGON WATCH

plastiglomerate
n. / ˌplas-ti-ˈglä-mə-rət /
A new type of stone formed when fragments of rock and seashell bond with melted plastic debris. Geologists classified plastiglomerate minerals for the first time after finding deposits on a polluted Hawaiian beach. Chunks of the stuff may last thousands of years.

nanodegree
n. / ˈna-nō-di-grē /
Industry-recognized certification in a technical field such as app development. The MOOC platform Udacity is offering the first nanodegrees, requiring a commitment of six to 12 months of part-time online study at a cost of a couple hundred dollars a month.

smorphs
n. pl. / ˈsmorfs /
Smart morphable surfaces. Fabricated by layering a stiffer but flexible silicone-based rubber over a squishy one, smorphs can change in texture from smooth to dimpled for enhanced aerodynamics. (The shift is actuated by suction that changes the internal pressure.) Engineers plan to use smorphs to protect buildings from hurricanes.

brobots
n. pl. / ˈbrō-ˌbäts /
Formally known in scientific papers as MagnetoSperm, these robots move and turn by wiggling their tails. Six times the size of human sperm cells, magnetically controlled brobots could eventually perform micro-biopsies and deliver drugs through the bloodstream.

—JONATHON KEATS
jargon@wired.com

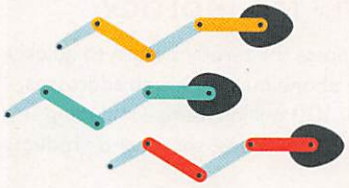
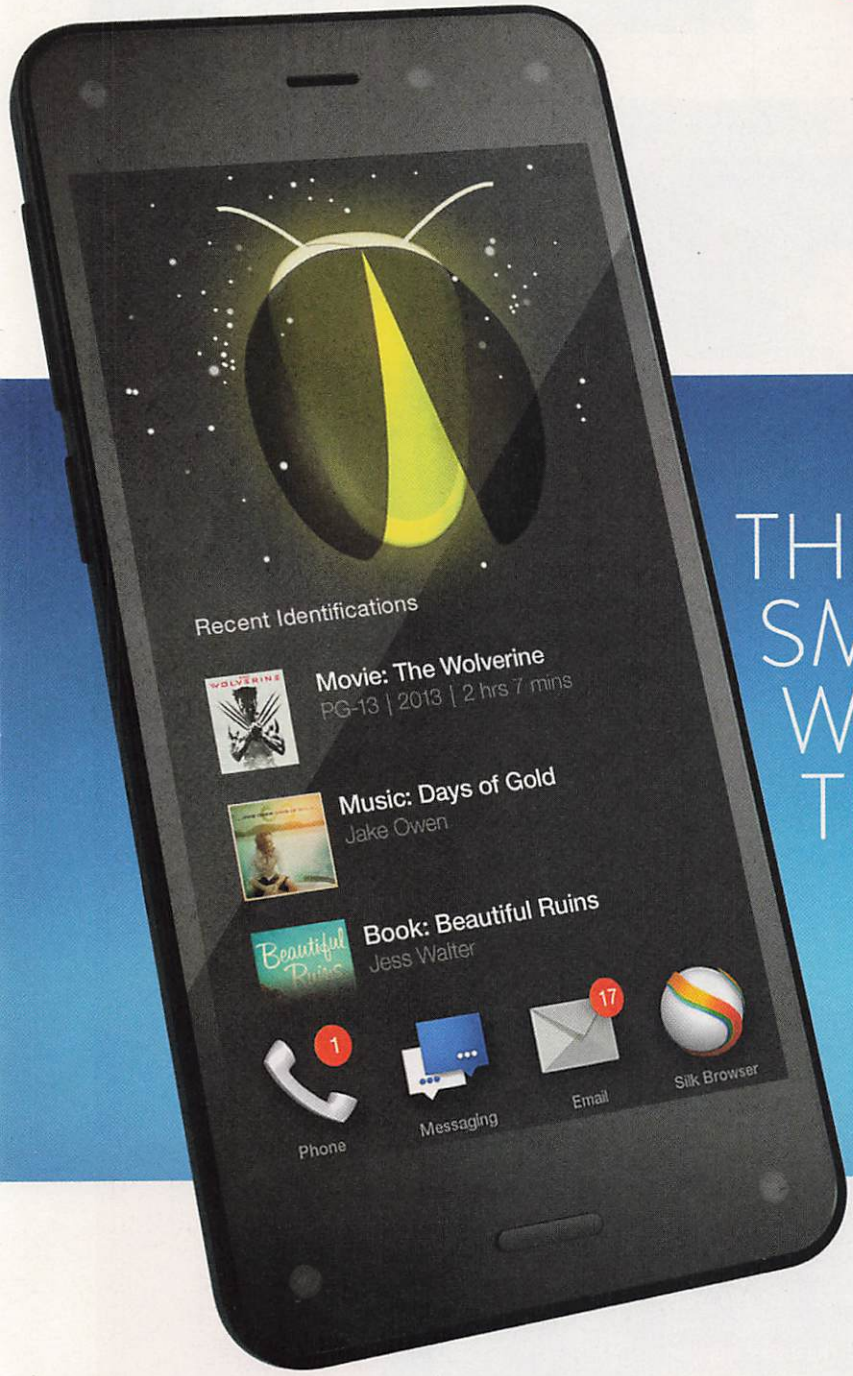


ILLUSTRATION BY THOMAS PORDSTOCKY

INTRODUCING

fire PHONE



THE ONLY SMARTPHONE WITH FIREFLY TECHNOLOGY

amazon

Exclusively on at&t

FIREFLY TECHNOLOGY

Simply press the Firefly button to quickly identify phone numbers, web addresses, and over 100 million items—including movies, TV episodes, songs, and products.

DYNAMIC PERSPECTIVE

Dive into a new class of immersive apps and games. Tilt, auto-scroll, swivel, and peek to navigate menus and access shortcuts with one hand.

LIMITED-TIME OFFER
INCLUDES A FULL YEAR OF PRIME

Enjoy 40,000 movies and TV episodes, over a million songs, 500,000 books to borrow, and FREE 2-day shipping on millions of items. Restrictions apply. See amazon.com/fireoffer for details.

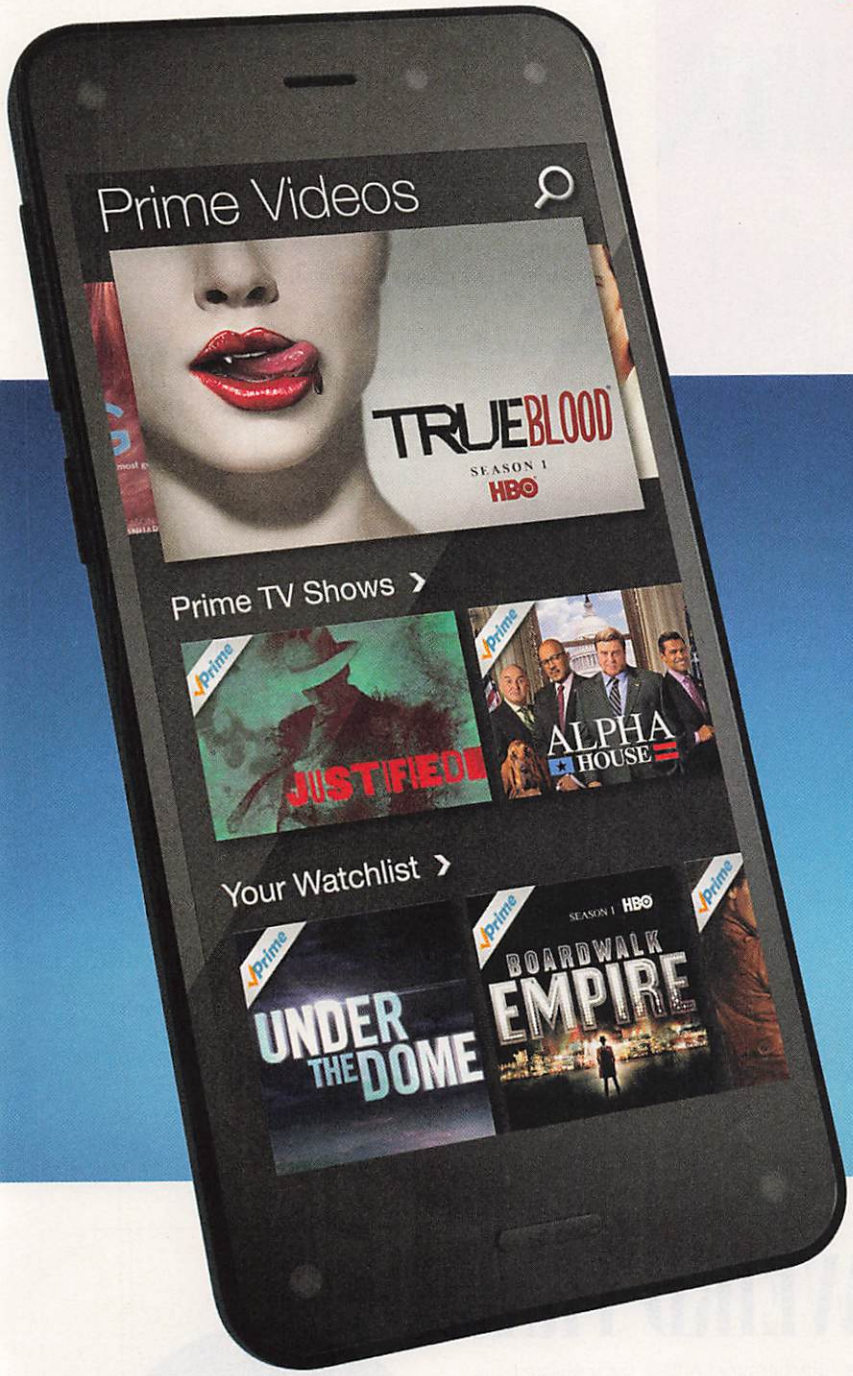
BY MATT JANCER | ROBYN TWOMEY

BLUE GOLD
JET FUEL FROM SEAWATER

ONE OF THE BEST things about working for the Navy, according to chemist Heather Willauer, is developing new technologies. That and access to the toy closet. One of her projects involved "50-ton blasts of TNT and water mist. That was great, watching that go kaboom," she says. Willauer is still playing with water and energy—but now she's turning seawater into jet fuel.¶ See, the ingredients for vehicle-powering hydrocarbons exist in every drop of seawater—hydrogen (in the form of H_2O) and carbon (as CO_2). But nobody knew how to separate and collect the stuff. Willauer, the principal investigator for the US Naval Research Laboratory effort, has been working on the problem since 2006, and in April her team synthesized a batch of fuel, put it in a remote-controlled plane with an internal combustion engine (above), and held their breath. The plane flew. ¶ This means aircraft carriers may one day be able to use power from their nuclear reactors to zap molecules from the ocean and recombine them into fuel for their fighters. And while the go-juice is still in the R&D stage, Willauer says a person holding a vial of fuel refined from the sea won't be able to tell it from the stuff that's pulled from the ground—and the jets won't know the difference either.

INTRODUCING

fire PHONE



LIMITED-TIME OFFER

INCLUDES A FULL YEAR OF PRIME

See amazon.com/fireoffer

amazon

Exclusively on at&t

FIREFLY TECHNOLOGY

Simply press the Firefly button to quickly identify phone numbers, web addresses, and over 100 million items—including movies, TV episodes, songs, and products.

DYNAMIC PERSPECTIVE

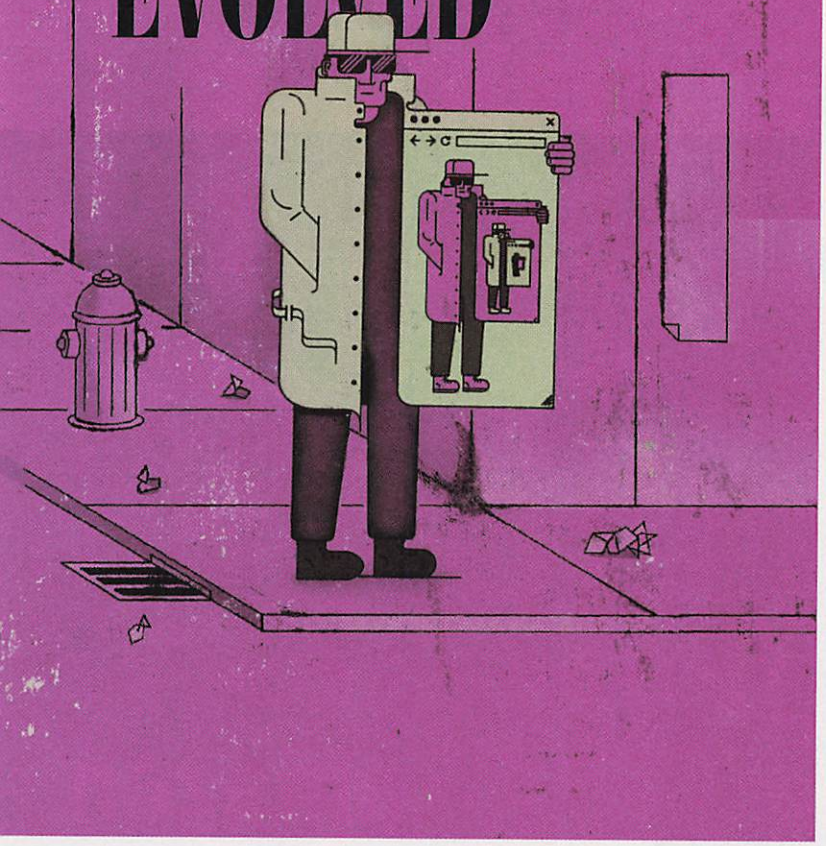
Dive into a new class of immersive apps and games. Tilt, auto-scroll, swivel, and peek to navigate menus and access shortcuts with one hand.

LIMITED-TIME OFFER
INCLUDES A FULL YEAR OF PRIME

Enjoy 40,000 movies and TV episodes, over a million songs, 500,000 books to borrow, and FREE 2-day shipping on millions of items. Restrictions apply. See amazon.com/fireoffer for details.

BY ANDY GREENBERG | YAREK WASZUL

BLACK MARKETS, EVOLVED



When the FBI tore down the billion-dollar drugs-and-contraband website Silk Road last October, its death made room for a new generation of black-market bazaars—many with better defenses against the Feds. Nearly a year later, *more* drugs are sold online than when the Silk Road ruled the dark web, according to a study by the Digital Citizens Alliance. Here's how the world of anonymous ecommerce has mutated and evolved.

Silk Road 2.0 ➔ **The Marketplace** ➔ **OpenBazaar**

A month after the FBI arrested 29-year-old Ross Ulbricht, the alleged Silk Road creator known as Dread Pirate Roberts, someone else using the same pseudonym launched Silk Road 2.0. This defiant clone of the original claimed that its source code was backed up to 500 locations in 17 countries, so if authorities shut it down, administrators can rebuild in 15 minutes flat.

In February, Silk Road 2.0 said it had been hacked, losing $2.7 million in user bitcoins. Tired of seeing their coins stolen or seized by the cops, savvy users migrated to sites like the Marketplace, which uses multisignature transactions—bitcoins are held in escrow at an address agreed on by buyer, seller, and the site. To move them, two out of three parties must sign off.

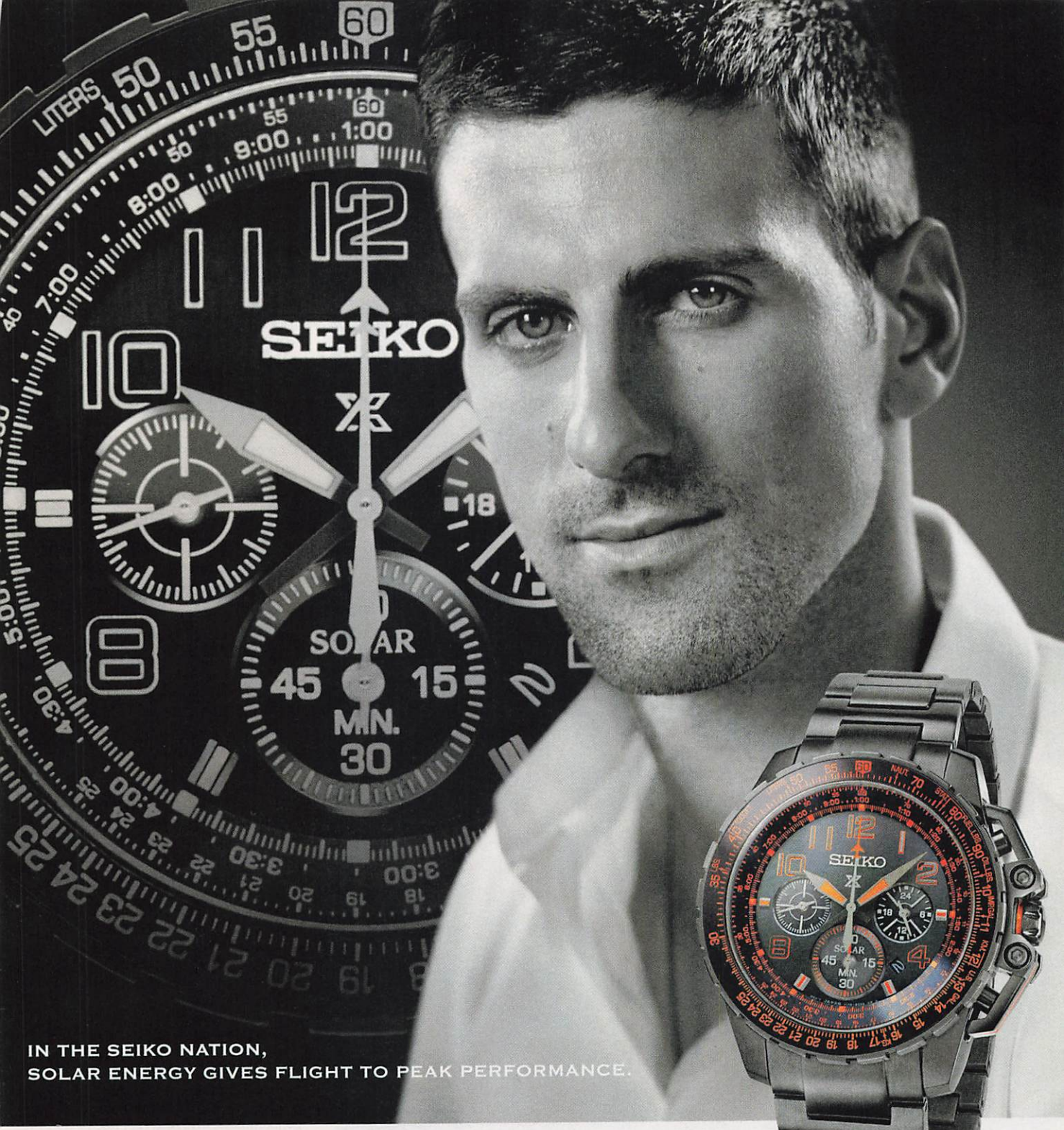
A Virginia coder named Brian Hoffman created this open source project to be a fully peer-to-peer uncensorable marketplace: Product listings are hosted on the computers of anonymous users, which makes it difficult for the Feds to shut things down, and freelance arbiters settle disputes for a fee. Hoffman says he's not inviting in drug dealers but that he can't stop them from crashing the party.

RECYCLING

CASH FOR WEIRD TRASH

PSST, NEED TO UNLOAD any flasks of virgin mercury? Allison Carmen can help. Her company, Material Mix, is a one-stop shop for leftover stuff, from bales of plastic to "salted cowhides." Carmen's goal is to be the Match.com for industrial scrap and recyclables, a $13.2 billion market in the US and one that's typically managed with phone calls, handshakes, and Excel docs. ¶ But handshakes and spreadsheets don't cut it in international deals, and a lot of potential buyers of America's castoffs are overseas. With the current setup, "you have this private market with just a few players that's offline," Carmen says, "so you really never know what the prices are." But Material Mix operates on a philosophy of transparency: By scraping and organizing data from trade groups, the site can give you a price for 1,500 tons of tantalum or 2,000 metric tons of frozen mackerel. And the salted cow skins? Scandinavia needs biomass for alt-energy programs, so the bovine hides can head to Norway and not the dump. —LEAH SHAFFER

ILLUSTRATION BY THOMAS POROSTOCKY



SEIKO

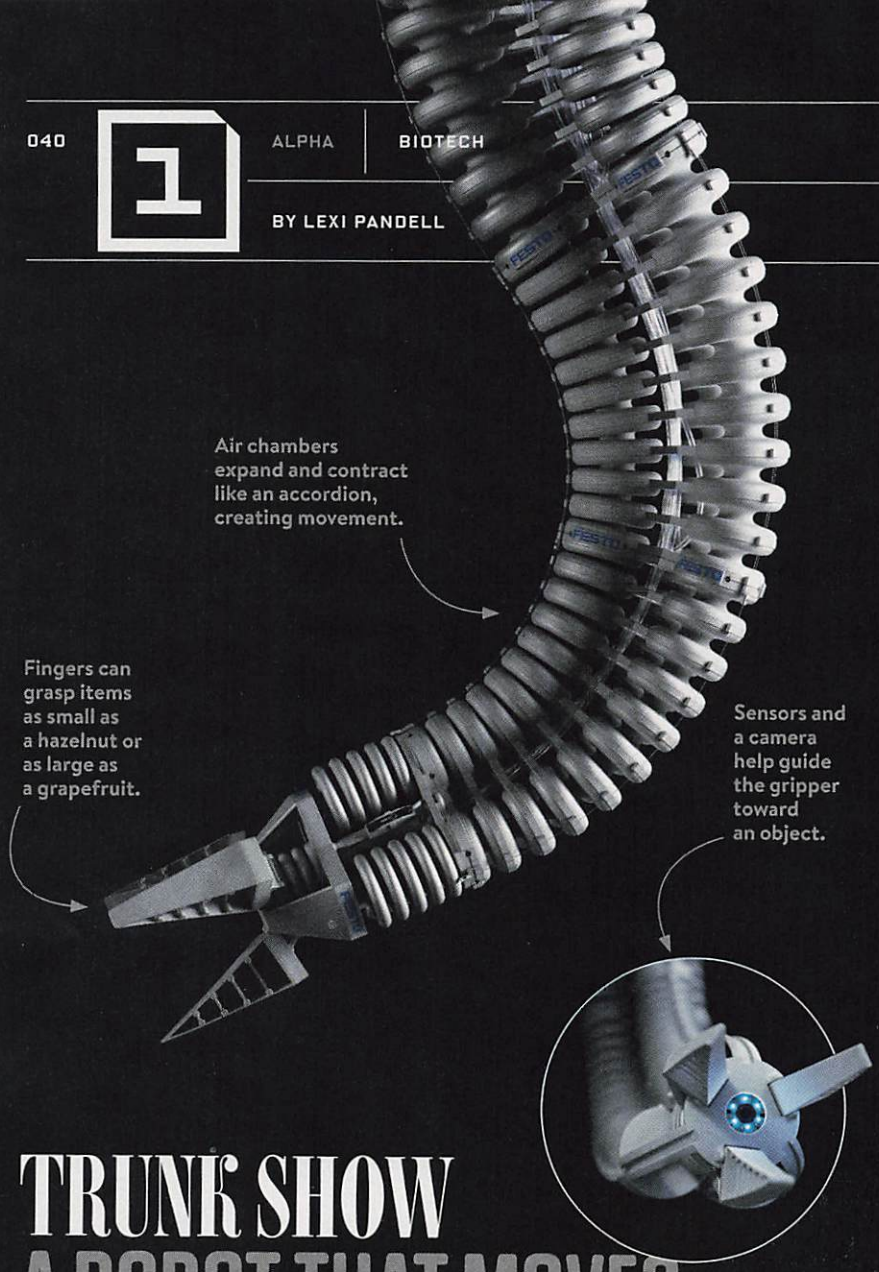
Every stroke, precisely calculated. Each game, expertly calibrated to conserve the energy needed to exert a winning burst of power. For tennis icon Novak Djokovic, his watch runs on these same progressive principles. **PROSPEX FLIGHT COMPUTER.** Solar-powered to be eco-friendly, no battery change is ever needed. Equipped with the apex of aviation technology required by pilots, it also precisely performs for those with the goal to progress above and beyond. SeikoUSA.com

PROGRESS TO SEIKO

AVAILABLE AT

SEIKO BOUTIQUE 510 Madison Avenue, New York, NY 212.355.3718

BY LEXI PANDELL



TRUNK SHOW
A ROBOT THAT MOVES LIKE AN ELEPHANT

THE BIONIC HANDLING ASSISTANT looks unsettlingly like one of Doc Ock's robo-tentacles, but rest easy—this bot only does things that people teach it to do. Unlike typical robotic arms, it has a wide range of motion and can operate safely alongside humans. ¶ The arm's maker, German company Festo, drew on the mechanics of an elephant's trunk; it reaches, contracts, and bends with the help of pneumatic actuators. "Nature has been optimized by billions of years of evolution to produce designs that are highly efficient and smart," Festo engineer Alexander Hildebrandt says. "Our aim is not to copy nature but to learn from it." Each of the three fingers, for example, flexes like a fish's tail to contour around irregular shapes, and they're sensitive enough to handle a lightbulb without breaking it. It learns through a process the researchers call goal babbling—remembering the position of its actuators as a human leads it through maneuvers. Plus, if it bumps into something, it yields before resuming its task. ¶ Eventually the arm might be used anywhere from factories to hospitals, but for now, a smaller, two-fingered version is mostly a teaching tool for robotics students. Whatever. Just keep it away from supervillains.

FIRST TO MARKET
SECONDHAND CLOTHES

One of the latest startup trends: online used-clothing stores. "Millennials don't want to own things," says Stephanie Tilenius, who sits on the board of Tradesy, a kind of eBay for apparel. "They want to rotate, they want the experience of new stuff." So dump your dud duds online—and treat yourself to something better. —VICTORIA TANG

Twice
$18.5 million raised in a Series B round in January 2014
Sellers mail gently worn items to this online store, which carries typical mall brands. Staffers inspect the pieces, take photos, and post them for resale. Goodwill gets the rejects.

Vinted
$27 million, Series B, February 2014
Step 1: Upload photos of your unwanted wardrobe pieces. Step 2: Set a suggested price. Step 3 (optional): Prepare to negotiate with short-on-scratch buyers. They might try to arrange a trade instead of a cash deal.

The RealReal
$20 million, Series C, May 2014
It's silly to pay $3,000 for a Louis Vuitton suitcase when you can get one for $1,000 at this fancy consignment site. And fear no fakes: Their authentication team includes gemologists, a horologist, and a fine arts specialist.

THOMAS PORDSTOCKY

WE ASKED PEOPLE HOW MUCH MONEY THEY WOULD NEED TO RETIRE.

THEN SHOWED HOW LONG IT MIGHT LAST.

Recently we conducted an intriguing experiment. We asked 200 people to think about how much money they'll need in retirement, then had them stretch out a length of ribbon representing that amount to see how long it might last. What we learned is that most of us significantly underestimate how much we'll need. The fact is, with people living longer, retirement could last up to 30 years or more. How can you make sure the money is there for you, year after year? Talk to your financial professional about our guaranteed retirement income solutions that can help provide annual income for each year of retirement from Day One.

TALK TO YOUR FINANCIAL ADVISOR OR VISIT BRINGYOURCHALLENGES.COM

RETIREMENT | INVESTMENTS | INSURANCE

Prudential
Bring Your Challenges®

© 2014. PRUDENTIAL FINANCIAL, INC., NEWARK, NJ, USA. ALL RIGHTS RESERVED.
0256203-00001-00

CLIVE@CLIVETHOMPSON.NET | BEN WISEMAN

THE NEW LIBRARY
MAKING IT WITHOUT BOOKS

VISIT THE DOWNTOWN BRANCH of the Chattanooga Public Library and you'll find the usual stuff: rows of books, magazines, and computers. But walk up to the fourth floor and there's something unexpected. It's a "makerspace"—complete with a laser cutter, a zine lab for making paper publications, and a 3-D printer. There's even a loom. ¶ When it opened in spring 2013, the maker floor—formerly unused and filled with decrepit equipment—became a massive hit, and up to 1,200 patrons attended events there. "Normally you hold a library event and you get six people," says Meg Backus, the systems administrator and chief maker for Chattanooga. But this new floor gives patrons access to new forms of literacy, ones they hunger after: design, programming, video editing, book writing, and website building. Consider it a glimpse into the future of libraries. They're becoming places to not just imbibe knowledge but create it—physically. Many people don't have access to classic hacker spaces, are intimidated by them, or can't afford them. "But here all you need is a library card," says CJ Lynce, who runs a similarly equipped space at the Cleveland Public Library. ¶ Chattanooga and Cleveland aren't the only cities giving this new kind of library a try. A survey by John Burke at Miami University found that 109 libraries in the US had a makerspace or were close to opening one. Others are hosting events like Wikipedia edit-a-thons, where residents plumb the library's resources to create articles about local history. (One library even has its own farm.) This ferment is attracting patrons; a Pew Internet survey found that these new modes bring in folks who normally shun libraries, typically men and people with limited education.

Ezra Reynolds is an example. As a kid he visited Chattanooga's main branch regularly but eventually stopped. Today he works assisting people with physical disabilities, and a year ago he adopted a son (now 2) whose arms end below the elbow. When Reynolds heard about the 3-D printer, he made his son a bunch of customized prostheses, including utensil- and pencil-holders. "This is what got me back in the door to the library after probably a 15-year hiatus," Reynolds says. When he visits the library now, he often shares his new skills. This is another part of the trend: spaces where people interact. Older folks teach sewing to the younger ones, who in turn teach them laser etching.

But what about books? Public Library Association research shows that people have checked out slightly fewer materials in recent years. And Pew found that about a third of patrons are opposed to makerspaces if they displace books. But while I'm just as sentimental about the primacy of hard copy, the librarians aren't. As they all tell me, their job is helping with access to knowledge—not all of which comes in codex form and much of which is deeply social. Libraries aren't just warehouses for documents; they're places to exchange information. "Getting people in a room, talking and teaching each other, is huge," Backus says. Nor are the makerspaces necessarily expensive. The Chattanooga project cost only $25,000.

You have to give the librarians credit. Stereotype says they're fusty, but the reality is absolutely the opposite. Over and over they've adapted to new information tools, from microfiche to CD-ROMs to the Internet. Now this—possibly the best example I've seen of how a storied institution embraces change. W

psst... up here.

it's amazing what can happen when your head's in the clouds.

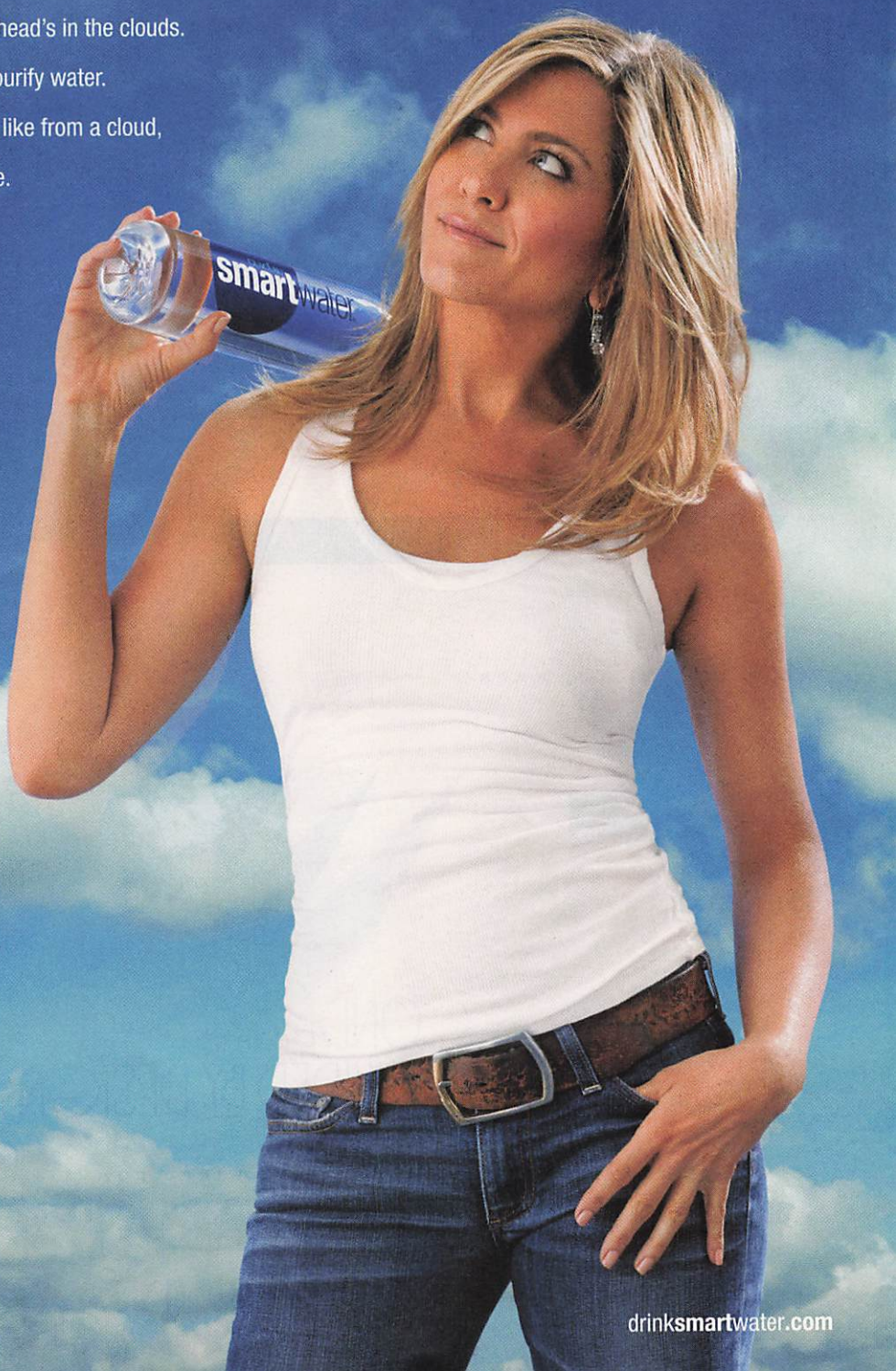
we looked up and saw a different way to purify water.

by vapor-distilling it, so it's pure and crisp like from a cloud,

then adding electrolytes for a distinct taste.

what will you see when you look up?

GLACÉAU
smartwater
inspired by the clouds



drinksmartwater.com

© 2014 glacéau. glacéau, smartwater, bottle design and label are registered trademarks of glacéau.

IAN BOGOST
JENNIFER COLLIAU
RYAN MILLER
JEFF NICHOLS
CINDY HOLLAND
WYATT MITCHELL
CARLTON CUSE
JAKE BARTON
DAN WINTERS
DAVID CHANG
PLATON
MARK WOOLLEN
GENTRY UNDERWOOD
NATASHA JEN
ROMAN ALONSO
YVES BÉHAR
DOUG AITKEN
CARL DETORRES
MARISSA MAYER
DAN DEACON
DAVA NEWMAN
PAMELA SHAMSHIRI
BJARKE INGELS
AARON KOBLIN

CONDÉ NAST PRESENTS:
WIRED BY DESIGN

SEPTEMBER 29-OCTOBER 1 / MARIN COUNTY, CALIFORNIA
LIVE.WIRED.COM

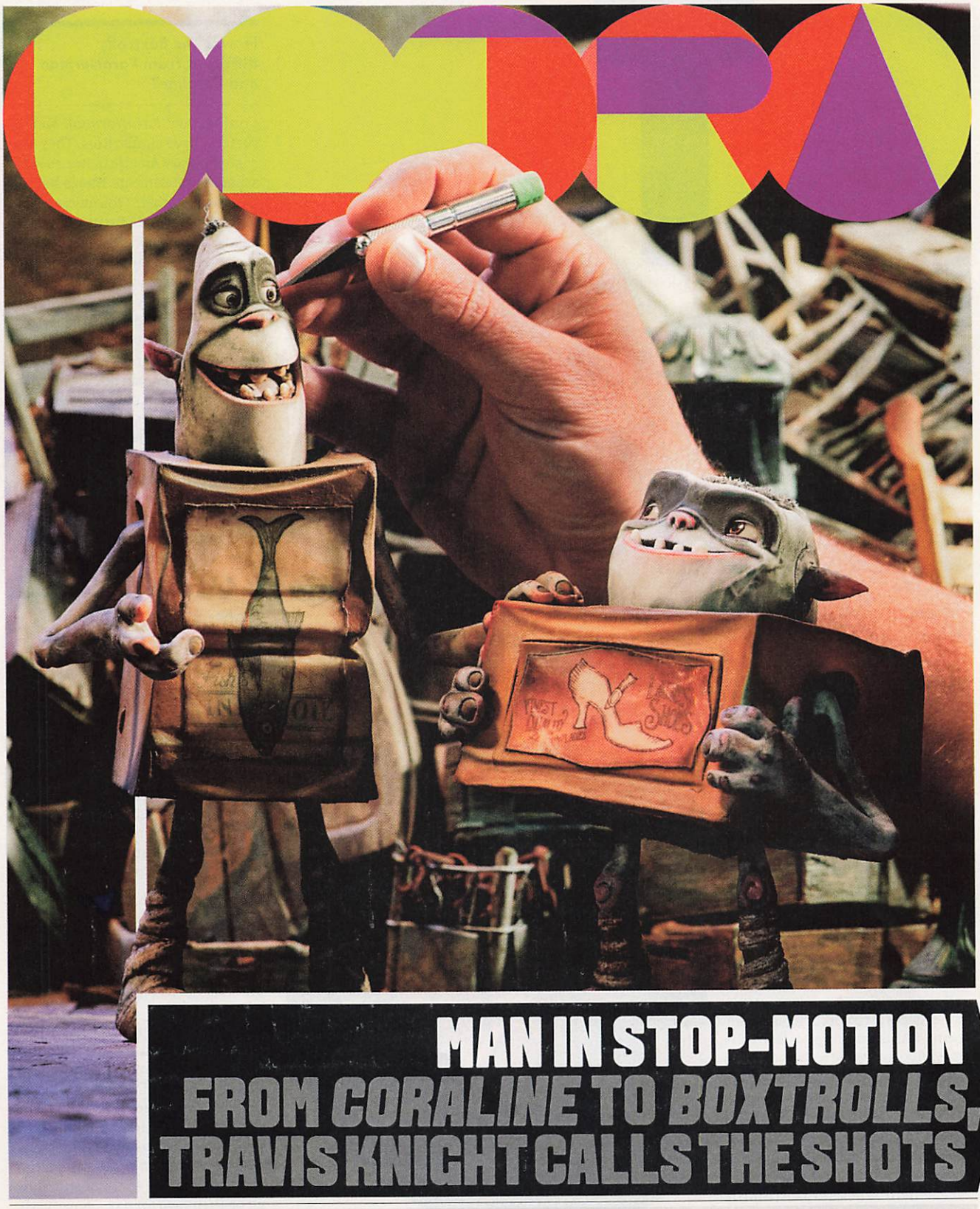
KLM Royal Dutch Airlines
MONT BLANC
OAKLEY

77
TV PILOTS AIRING ON THE BIG FOUR NETWORKS THIS FALL p.54

EIGHT THOUSAND
PIECES OF MAPLE WOOD USED BY ROXY PAINE TO BUILD A MODEL OF AN AIRPORT SECURITY CHECKPOINT ..... p. 50

3.71×10^{15}
CALORIC VALUE OF EARTH'S INNER CORE, IF IT WERE MADE OF CARAMEL ..... p. 52

$231,735,797
COMBINED LIFETIME GROSS REVENUE OF ANIMATOR TRAVIS KNIGHT'S FIRST TWO FEATURE FILMS WITH LAIKA, *CORALINE* AND *PARANORMAN* ..... p. 46



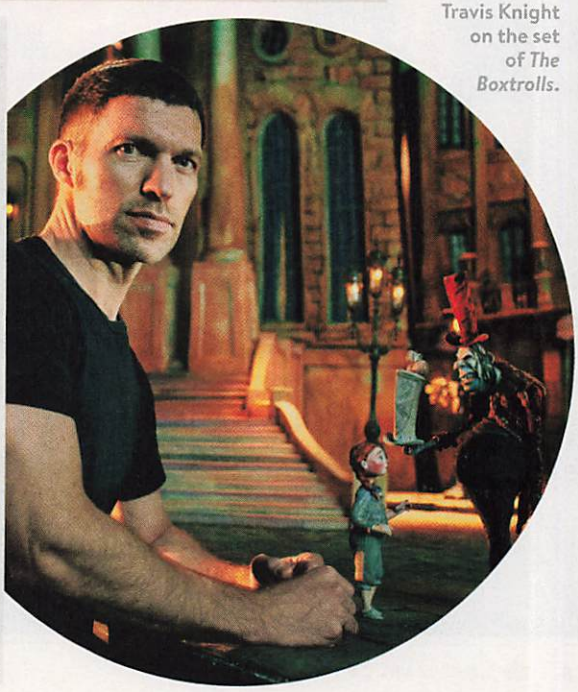
MAN IN STOP-MOTION
FROM *CORALINE* TO *BOXTROLLS*, TRAVIS KNIGHT CALLS THE SHOTS

BY CAITLIN ROPER | JOSE MANDOJANA

TRAVIS KNIGHT arrives at his animation studio at 7 most mornings, spending a few hours moving puppets a millimeter at a time, coaxing characters to life. But then it's time to leave the soundstage for a day of meetings. Knight isn't just the lead animator of Laika, the Portland-area outfit that's risen to prominence in the past five years, he's also its president and CEO. It's a tough balancing act. Then again, Knight is used to balancing acts, marrying the venerable art of stop-motion animation with computer-generated effects. The results have been stellar—both *Coraline* (2009) and *ParaNorman* (2012) won Oscar nominations for their creepy artistry. The studio's latest film, September's *The Boxtrolls*, is its most audacious yet. Laika continues to push the bounds of rapid prototyping, 3-D-printing all of the puppets' faces in color, and *The Boxtrolls* adds a period setting and nonhuman characters to tell the story of a stratified Victorian town where the wealthy live up high and a band of misunderstood monsters lives down below. Knight says he wants to tell stories with "an artful balance of darkness and light, intensity and warmth." And he, more than anyone, has a hand in making it so. Two hands, even.

How has Laika changed over the past few films?

Historically, for a stop-motion film, you gathered the crew together, you made the movie, and then everyone ran screaming to the next project. But we have a core team. By going from film to film together like we have, all the innovations that happen over the course of making a film, from 3-D printing our characters' faces in color to advances in rigging or lighting, stay with us. All of the things we learned on *Coraline* we applied to *ParaNorman*, and all of the things we learned on *ParaNorman* and *Coraline* we applied to *The Boxtrolls*. In the time that we've been making films, every single department has achieved dramatic technical innovations. And those gains enable us to be more expansive in the kind of films we make.



Travis Knight on the set of *The Boxtrolls*.

How is *The Boxtrolls* different from *ParaNorman* and *Coraline*?

Coraline and *ParaNorman*, on the surface, have similarities. They are contemporary American stories with supernatural elements. People started to pick up on that: "You guys are the ones who do kind of scary films for kids." While I think there are certainly elements of that in *Coraline* and *ParaNorman*, we wanted to make sure that didn't start to define who we are. We're not just the animated horror film company. That's an aspect of what we do, but it's not really at the core of who we are. *Coraline* and *ParaNorman* are very different stories. *Coraline* is kind of a dark-tinged modern fairy tale. *ParaNorman* is kind of a supernatural comedic thriller. *The Boxtrolls* is very different. It's an absurdist coming-of-age comedy. It's set in this Dickensian world, Victorian-era, but it has fantastical elements, things we haven't done before, like creatures.

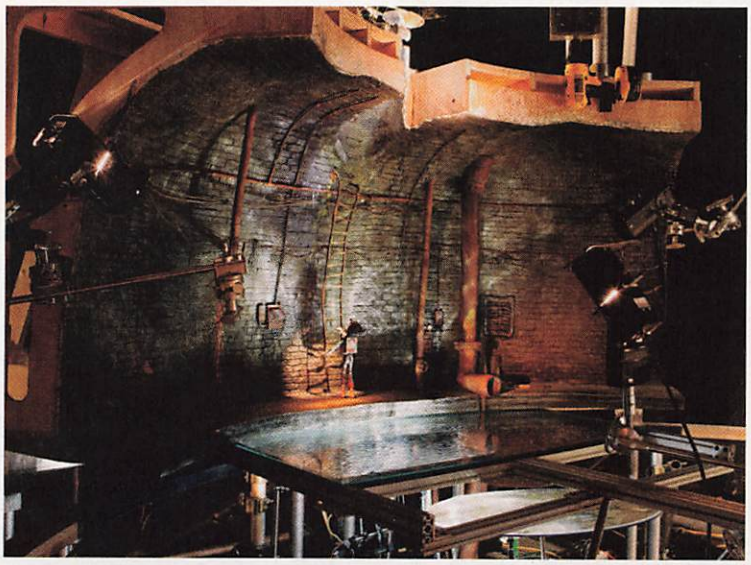
Right—people often think animation is a single genre, but you don't see it that way.

I can kind of excuse people for thinking that. As artists, I think we've done our art form a disservice by continuing to tell the same kind of stories in the same kinds of ways. Historically, there's been a degree of sameness to animated films. But we see animation as more than a genre. It's a powerful visual medium that can be used to tell virtually any kind of story in virtually any kind of genre.

You started as an animator but became CEO. What part of that transition was a struggle?

Artists are neurotic and hypersensitive, and they tend to focus on granular details, sometimes at the expense of the big picture. I've gotten better at the big picture over the years. But animation—especially stop-motion—is really a solitary existence: Ultimately, when a shot is set up, the animator is alone, bringing this puppet to life all on their own for days, sometimes weeks on end. One of the most dra-

BANG & OLUFSEN
Sound has never looked so good.
The new BeoVision Avant is an Ultra High-Definition, 4K Smart TV with iconic sound that is the culmination of 89 years of fearless design and innovation. The result is a fusion of clarity and power that truly embodies Bang & Olufsen's commitment to immaculate vision and sound. Experience it in store today. Available in both 55" & 85" with multiple mounting options. Starting MSRP: $7,995
For more information, please visit bang-olufsen.com/avant or to find your closest showroom please visit bang-olufsen.com/store-locator



Four hundred Laikans worked on *The Boxtrolls*, creating 190 puppets, 53,000 faces, 200 costumes, and 20,000 props.

matic changes for me as a CEO has been dealing with lots of different kinds of people about a lot of different issues. I had to figure out how to navigate that—it was initially kind of jarring and slightly uncomfortable.

How do you make decisions about what to animate by hand and what should be CG?

We ask, what makes the most sense? A prime example in *The Boxtrolls* is the Mecha-Drill. It's the biggest puppet we've ever made. And there was a discussion: Should we do it at half-scale? Quarter-scale? Should we do it entirely in CG? We built in motion-control devices we usually use for our cameras. It's the first time we've done anything like that, but the drill felt like an opportunity to do something special at 100 percent scale. I'm not a purist, but I think that the stuff we can capture in-camera helps create a unified perspective of the world we're building. If you're trying to tell sophisticated stories, the execution has to have that same level of visual sophistication or the audience will see a puppet as a doll. We want people to see them as real living things.

What characters did you animate on *The Boxtrolls*?

I had my hands on pretty much every main character.

Do you ever go back and change something?

The threshold is very high to reshoot, because it's incredibly difficult to do. The fact that you can't go through and kind of tweak everything to death is one of the unique charms of stop-motion. It's performance art. Each performance starts in one place and ends in another. The animator brought that thing to life with two hands—lightning very slowly captured in a bottle. But animators are actors. In hand-drawn animation, they're acting with a pencil or a computer. In our case, we're coaxing the performance out of these puppets, so we try to be careful to cast the right animators for the right scenes.

How do you reconcile Laika's combination of cutting-edge technology and hand-craftsmanship?

The atmosphere here crackles with energy; people are constantly coming up with new ideas. I think that in large measure that's because of the fusion of different disciplines that we have—Luddites, craftspeople who don't know a thing about technology, converging and working with futurists, people who do nothing but try to figure out the next thing, the next bit of cutting-edge technology they can bring to the process. They don't always play well together, but often the best solutions come out of that tension.

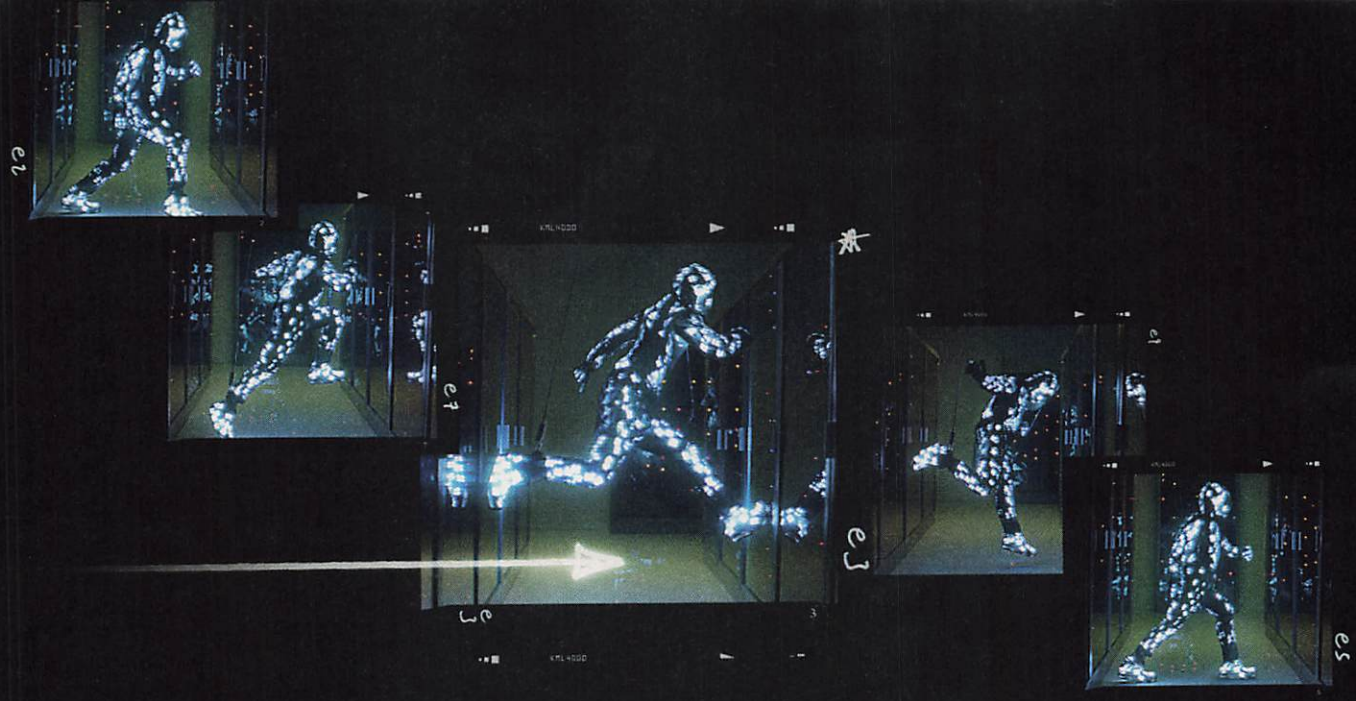
I know you won't tell me about upcoming films you haven't announced, but I can't help wondering if you'll make a space movie with aliens.

Right, it's exciting to imagine some of these genres that are generally untapped in animation—westerns, musicals, space films.

So you *do* know what the next film is?

I do know. It's so good. You're going to dig it.

Senior editor CAITLIN ROPER (@caitlinroper) *wrote about* ParaNorman *in issue 20.08.*

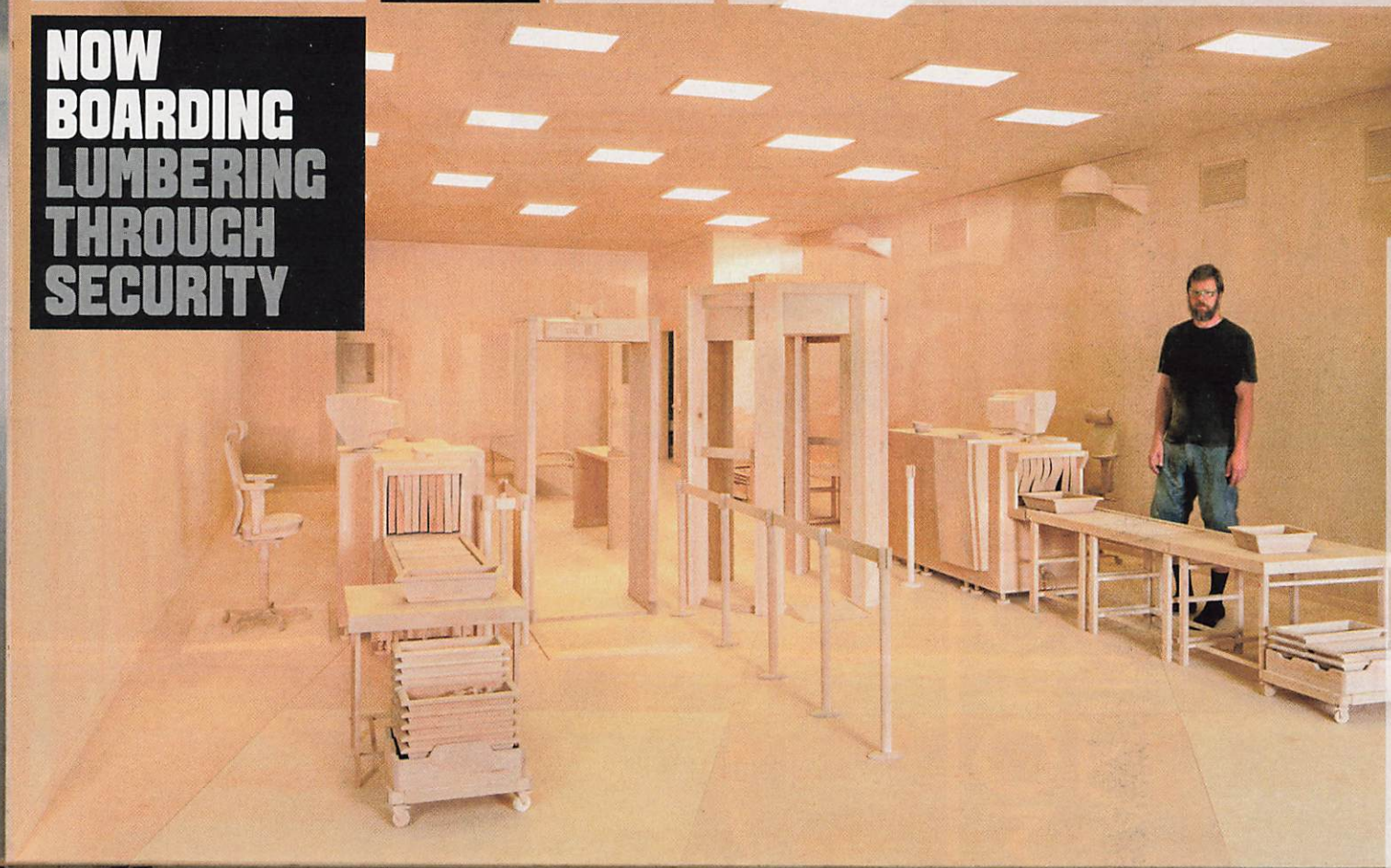


AMAZING IN MOTION

A series of global projects showcasing innovative design and technology through imagination. The latest project combines 50,000 LED lights, 40 expert engineers, 30 stuntmen and one Hollywood costume designer to create incredible movement. Discover more at **amazinginmotion.com/strobe**

LEXUS

NOW BOARDING LUMBERING THROUGH SECURITY



TO ROXY PAINE, airport security is more than a hassle. It's art. The New York–based sculptor has turned mundane spaces like a fast food restaurant and a control room into painstakingly detailed dioramas. For his newest piece, *Checkpoint*, Paine spent 10 months carving, cutting, and CNC-milling more than 8,000 pieces of maple into a TSA screening station, down to the bending flaps of the x-ray machines. The original model is 75 feet long, so Paine used forced perspective to squeeze it all in; his version is 13 feet tall in front but just 5 feet high in back. It's a technical triumph, but Paine's real accomplishment is reinterpreting a place so universally loathed. "When you're in this space in real life, you can't wait to get through it," he says. A chance to linger at his checkpoint, though, would be worth missing a flight. —LIZ STINSON

FLOTO + WARNER

To see more of Paine's work, get the WIRED app for tablet.

THE SCENE

NOT EVERY VIDEO.
JUST THE ONES WORTH
TALKING ABOUT.

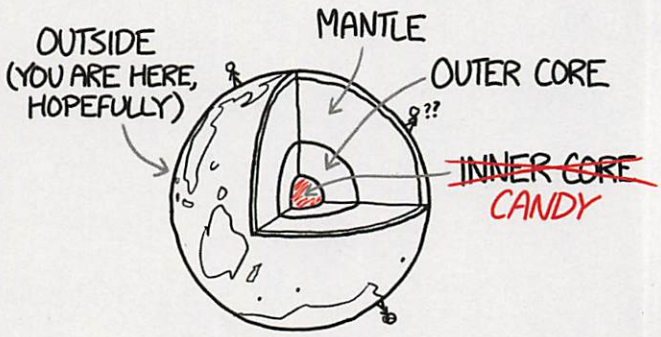
WIRED

WIRED VIDEOS ARE NOW ON THE SCENE

FEATURING "HOW TO TO MAKE A GIANT CREATURE"

THESCENE.COM/WIRED
FOLLOW US ON TWITTER @SCENE

CARAMEL APOCALYPSE
EARTH WITH A CANDY CENTER

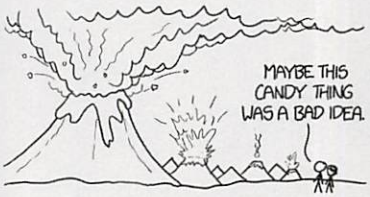


IN SEPTEMBER, Randall Munroe—creator of genius web comic *xkcd*—is publishing a book compiling his popular "What If" column, in which he answers radically implausible questions in a radically logical way. Munroe offered to answer a question just for WIRED, this one sent in to him by Amy Bullivant of Colchester, UK.

Q: What if Earth's core were replaced by candy?

A: We'd lose satellite TV reception. Then everyone would die.

Gravity pulls Earth together, which puts the planet's metal core under extreme pressure. If we replaced the inner core with candy, the pressure would compress the sugar and Earth would begin to shrink. The good news is that the collapse would be slow, since Earth's mantle is very rigid, so we wouldn't notice the shrinking ... at first.



Sugar is much less dense than the metals in deep Earth. If our core were replaced by candy, Earth's mass—and gravitational pull—would decrease, and we'd all get a few pounds lighter. If you were sitting still when it happened, you might get a brief and mild floating sensation in your stomach, like what you feel when you drive too fast over a hill.

Your phone's GPS would stop working. The GPS system depends on precise knowledge of satellite orbits. If Earth's mass changes, those calculations all break down. Your location on the map would start drifting, then you'd lose the GPS lock completely.

Satellite TV would suffer a similar failure; geostationary satellites would suddenly find themselves out of sync with Earth's rotation and would drift out of alignment with satellite dishes.

Then the earthquakes would begin.

Since the candy core would be slowly but surely compressing under Earth's weight, the contraction would squish and wrinkle the crust, pushing plates together. Areas like Japan, Indonesia, and the west coast of the Americas typically experience a catastrophic earthquake every few decades, but on our candy world, they'd experience one every few *hours*.

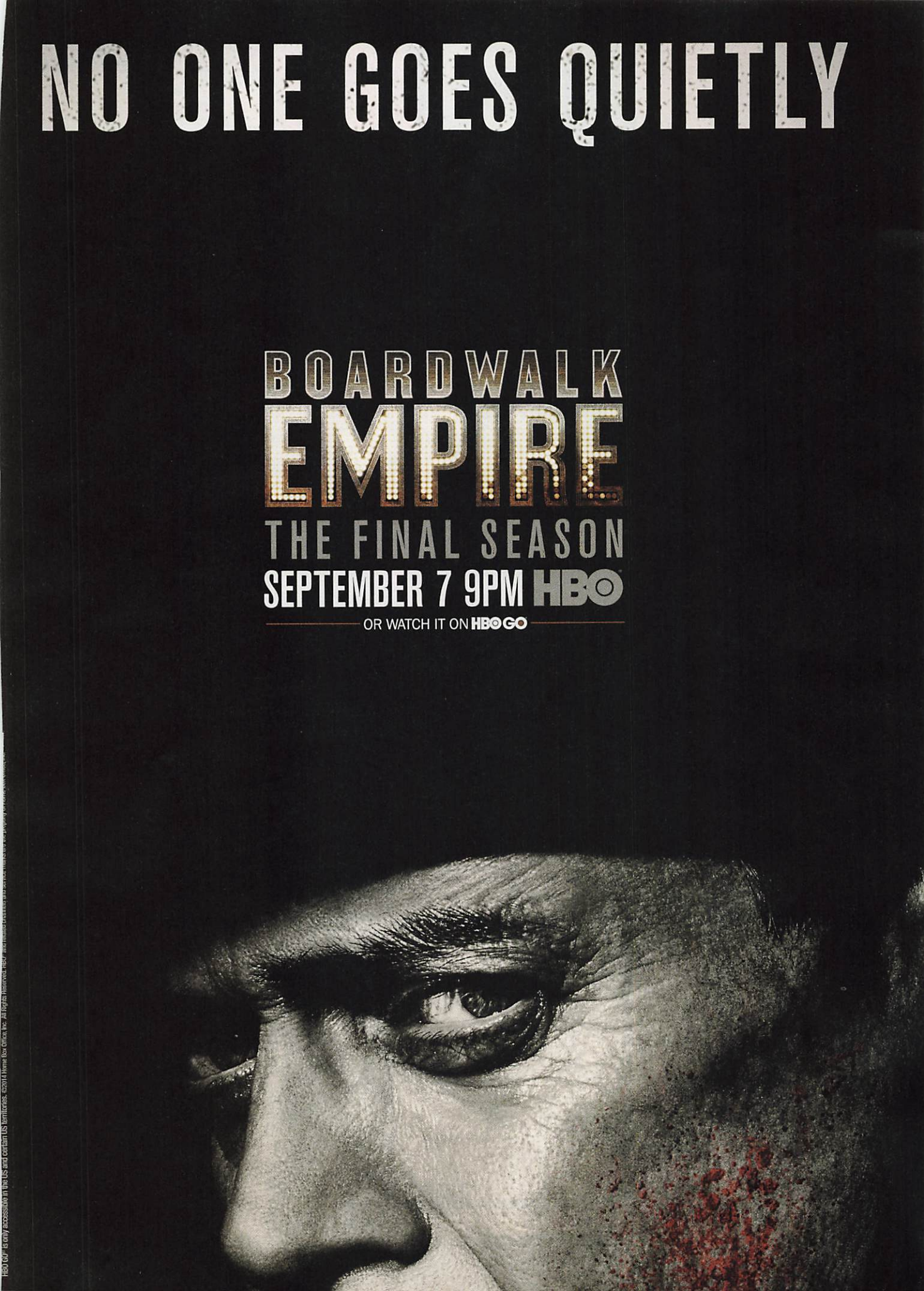
Volcanic activity would similarly accelerate, with supervolcanoes likely erupting left and right. Ash and lava flows would spread across the surface. We humans would probably not last very long.

Hidden from view at the center of Earth, the candy itself would begin to transform. The sugar would break down under the weight and heat of the planet, and the carbon would crystallize out into diamonds.

It's a shame to let that much food go to waste, but maybe it's for the best. If we decided to leave Earth's core alone, and instead divided the candy up between us, every human would get a pile the size of a mountain.

But while a candy mountain might sound delicious, before you dive in, remember: Burning off that many calories would take more than a billion years of jogging.

RANDALL MUNROE *is the author of* What If? Serious Scientific Answers to Absurd Hypothetical Questions, *to be published in September.*


NO ONE GOES QUIETLY
BOARDWALK
EMPIRE
THE FINAL SEASON
SEPTEMBER 7 9PM HBO
OR WATCH IT ON HBO GO
HBO GO® is only accessible in the US and certain US territories. ©2014 Home Box Office, Inc. All Rights Reserved. HBO® and related credits are trademarks of Home Box Office, Inc. Visit us at HBO.com

NOOB TUBE

TWO TOTALLY UNQUALIFIED CRITICS PREVIEW THE NEW FALL SEASON.

EACH FALL, a new crop of shows hits the air—and we're forced to gamble on which ones will be worth watching. After all, for every *Arrow*, there's a *Dracula*. Hoping to get a bead on this season's prospects, we asked Jonah Ray and Kumail Nanjiani, cohosts of the Comedy Central stand-up series *The Meltdown With Jonah and Kumail*, to review a few. They've only seen the shows' trailers, but when has that ever stopped a nerd from passing judgment?

GOTHAM (FOX)

Prequel alert! Fox gets in on the comic-book fun by imagining the future Commissioner Gordon as a rookie detective investigating the murders of young Bruce Wayne's parents.

RAY: There are younger versions of every future villain and superhero. It's basically *Batman Babies*.

NANJIANI: There's a skinny Penguin. Is there a lot of emotional eating coming up?

RAY: I can't wait for someone to punch Gordon in the face and go, "Welcome to Gotham City. That's the G.C., bitch!" That's a reference to the television show *The O.C.*

SELFIE (ABC)

In this Facebook-era sitcom version of *My Fair Lady*, *Doctor Who*'s Karen Gillan plays the Eliza Doolittle role (in this case Eliza Dooley).

NANJIANI: I thought the whole show was gonna be shot on front-facing iPhone cameras.

RAY: I'm hoping that all the social media references will be a gateway for shitty people to watch it and then learn how shitty they are.

NANJIANI: In the trailer she says, "We can do anything. But no back-door stuff." I would love if that's the hashtag they're trying to get out there for the pilot. *#backdoorstuff*

CONSTANTINE (NBC)

Based on DC Comics' *Hellblazer*, this supernatural-detective drama hews closer to the source material than the 2005 Keanu Reeves film version—which would normally give us hope, except for one of the things they apparently changed.

NANJIANI: In the comics, John Constantine is a chain smoker who gets lung cancer. They took that out. Now he's just a really bummed-out British guy who can commune with the dead.

RAY: They should have got Morissey to play him.

NANJIANI: But even the ghosts would be like, "You're really bumming me out, dude—and I'm dead."

SCORPION (CBS)

A team of ultragenius hackers (and Katharine McPhee as an everywoman waitress, because why not?) use their l33t skills to avert global crises.

NANJIANI: In the trailer, the software update messes up all the plane systems. Whenever a computer software update comes up on my computer, I'm like, "What's the worst that can happen if I don't do this?" Oh, *80 planes will crash*.

RAY: I don't think anyone's gotten hacker culture right since the movie *Hackers*.

NANJIANI: Or the TV show *Silicon Valley* that's on HBO. That show really nails it.

BY MARK YARM | EMILY SHUR

WARDROBE STYLING BY GIOLLIOSA & NATALIE FULLER/SISTER STYLING; PROP STYLING BY KYLE KINSELLA.

WORK BETTER

"Technology is an integral part of how we plan, execute and document construction projects. Ubiquitous access to the most up-to-date information, what I call the 'single source of truth,' eliminates uncertainty and helps us focus on planning and building. We use Revu to create digital plan rooms, maintain access to the latest project documentation from anywhere and collaborate on the same set of PDFs with owners, designers and subs in real time."

Chad Dorgan
VP Quality and Sustainability

McCARTHY®

Be Better.
bluebeam.com/truth

bluebeam®
NO LIMITS®

Bluebeam®, Revu® and Bluebeam Studio™ are Trademarks or registered Trademarks of Bluebeam Software, Inc. © 2002 - 2014 Bluebeam Software, Inc. All Rights Reserved.

AT&T is the nation's most reliable 4G LTE network.

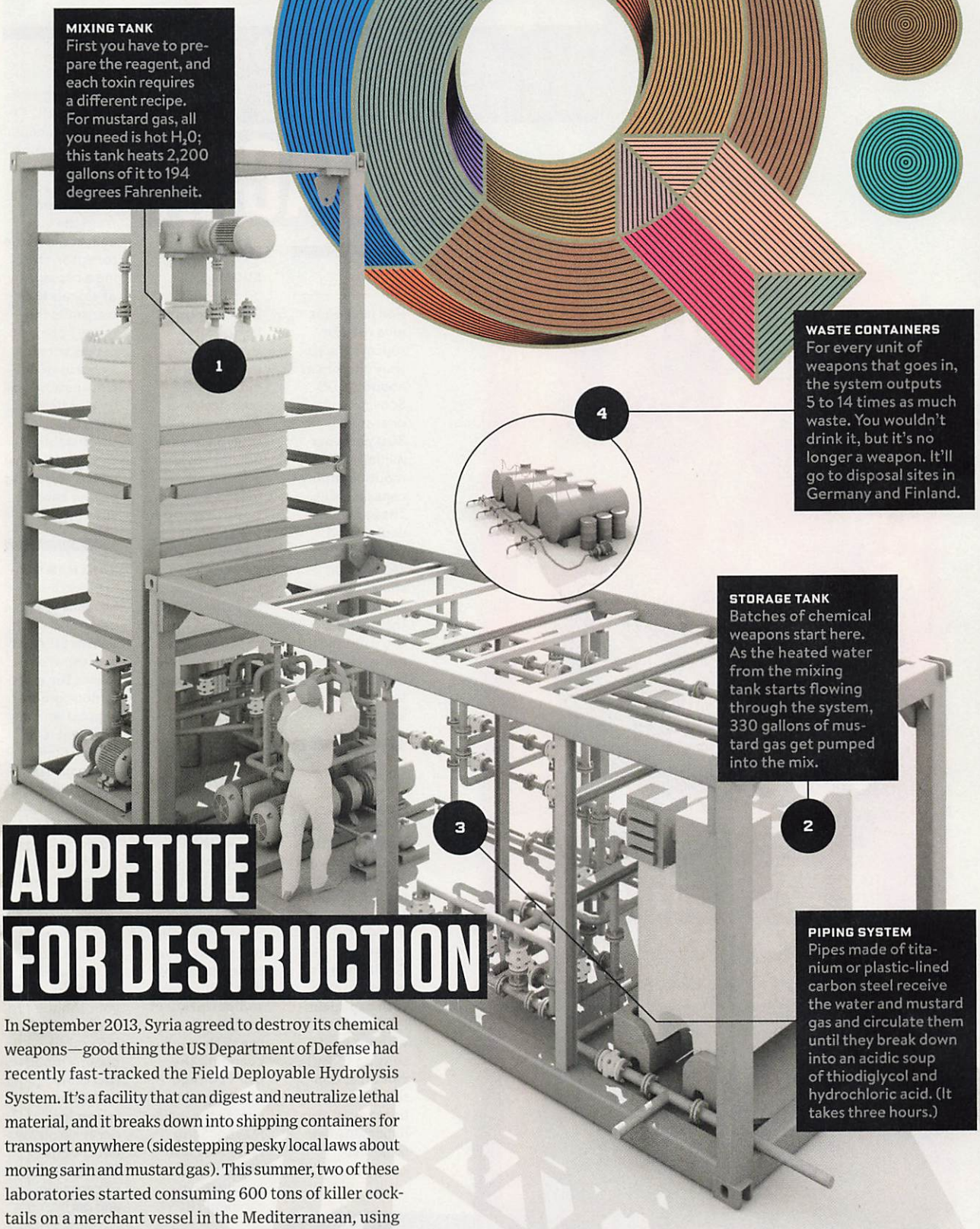
So you can stream the action from virtually anywhere.

Building you a better network.℠

MOBILIZING
YOUR
WORLD™

Visit a Store | ATT.COM/network | 1.866.MOBILITY

Based on 3d party data re nationwide carriers' 4G LTE. LTE is a trademark of ETSI. 4G LTE not avail. everywhere. Screen images simulated. ©2014 AT&T Intellectual Property. All rights reserved. All other marks used herein are the property of their respective owners.



MIXING TANK
First you have to prepare the reagent, and each toxin requires a different recipe. For mustard gas, all you need is hot H_2O; this tank heats 2,200 gallons of it to 194 degrees Fahrenheit.

WASTE CONTAINERS
For every unit of weapons that goes in, the system outputs 5 to 14 times as much waste. You wouldn't drink it, but it's no longer a weapon. It'll go to disposal sites in Germany and Finland.

STORAGE TANK
Batches of chemical weapons start here. As the heated water from the mixing tank starts flowing through the system, 330 gallons of mustard gas get pumped into the mix.

PIPING SYSTEM
Pipes made of titanium or plastic-lined carbon steel receive the water and mustard gas and circulate them until they break down into an acidic soup of thiodiglycol and hydrochloric acid. (It takes three hours.)

APPETITE FOR DESTRUCTION

In September 2013, Syria agreed to destroy its chemical weapons—good thing the US Department of Defense had recently fast-tracked the Field Deployable Hydrolysis System. It's a facility that can digest and neutralize lethal material, and it breaks down into shipping containers for transport anywhere (sidestepping pesky local laws about moving sarin and mustard gas). This summer, two of these laboratories started consuming 600 tons of killer cocktails on a merchant vessel in the Mediterranean, using heat and chemistry to turn poison into trash.

"Q" BY CLAUDIA DE ALMEIDA

WHAT'S INSIDE SRIRACHA

CHILI

Red jalapeños give rooster sauce its heat; they clock in at about 5,000 Scoville units, or around 300 parts per million of mouth-burning capsaicinoids. These molecules bind to a receptor, TRPV1, that shows up on the ends of nerves that lead to the trigeminal nerve, which conveys touch, temperature, and pain.

GARLIC

The sulfur-based molecules that give garlic its stink activate another trigeminal receptor, TRPA1, the same protein behind wasabi's tingle. Garlic seems to be intertwined with capsaicin: People born without heat-sensing TRPV1 can't feel capsaicin's burn, but they're also hypersensitive to garlic.

SUGAR

Chili and garlic operate through the trigeminal nerve, but the five main tastes—sweet, salty, sour, bitter, and umami—use a whole other mechanism. For sweet, a receptor grabs an L-shaped structure common to sugar and artificial sweeteners. When any of those nestle into the groove, they start a cascade of messages that make the brain say, "Sweet!"

SALT

Unlike the lock-and-key receptors that signal sweet, salt is likely detected by ion channels on cells in your taste buds. Positively charged sodium ions (the Na in NaCl) sneak through, changing the cell's voltage and triggering a ping to the brain. Maybe. Salty taste may also depend in part on capsaicin-catching TRPV1.

DISTILLED VINEGAR

As with salt, a channel receptor telegraphs the sour taste of acetic acid. Free protons from the vinegar activate the receptor, starting a cascade of signals that transmits the tangy note that makes sriracha a chorus of deliciousness. Acidity also helps keep this sauce shelf-stable—though we know it won't last long in your cabinet anyway.

XANTHAN GUM

Sriracha is a general class of Southeast Asian sauces; what makes the more famous green-capped version different is this thickener, which gives it good "cling" to tofu, eggs, or oatmeal. (Hey, we don't judge.) But it also completes a flavor triple crown: taste, smell, and texture. Sriracha sticks to mechanoreceptors on your tongue too, sending info about creamy mouthfeel down that same trigeminal nerve—a pleasant change from the sting of capsaicin and garlic.

ONE VERY, VERY MOBILE 4G WI-FI HOTSPOT.

Stop at the coffee house for the dark roast, not the Wi-Fi. Beginning later this year, the all-new 2015 GMC Yukon Denali will offer OnStar 4G LTE with an available built-in Wi-Fi hotspot.* This innovative technology turns your vehicle into the ultimate mobile hotspot with capability for up to seven devices and an Internet signal more powerful than your smartphone.* Yukon Denali itself is plenty mobile, too. Thanks to a powerful EcoTec3 V-8 engine and road-smoothing Magnetic Ride Control. It's incredible thinking that keeps you connected to the road—and just about everything else.

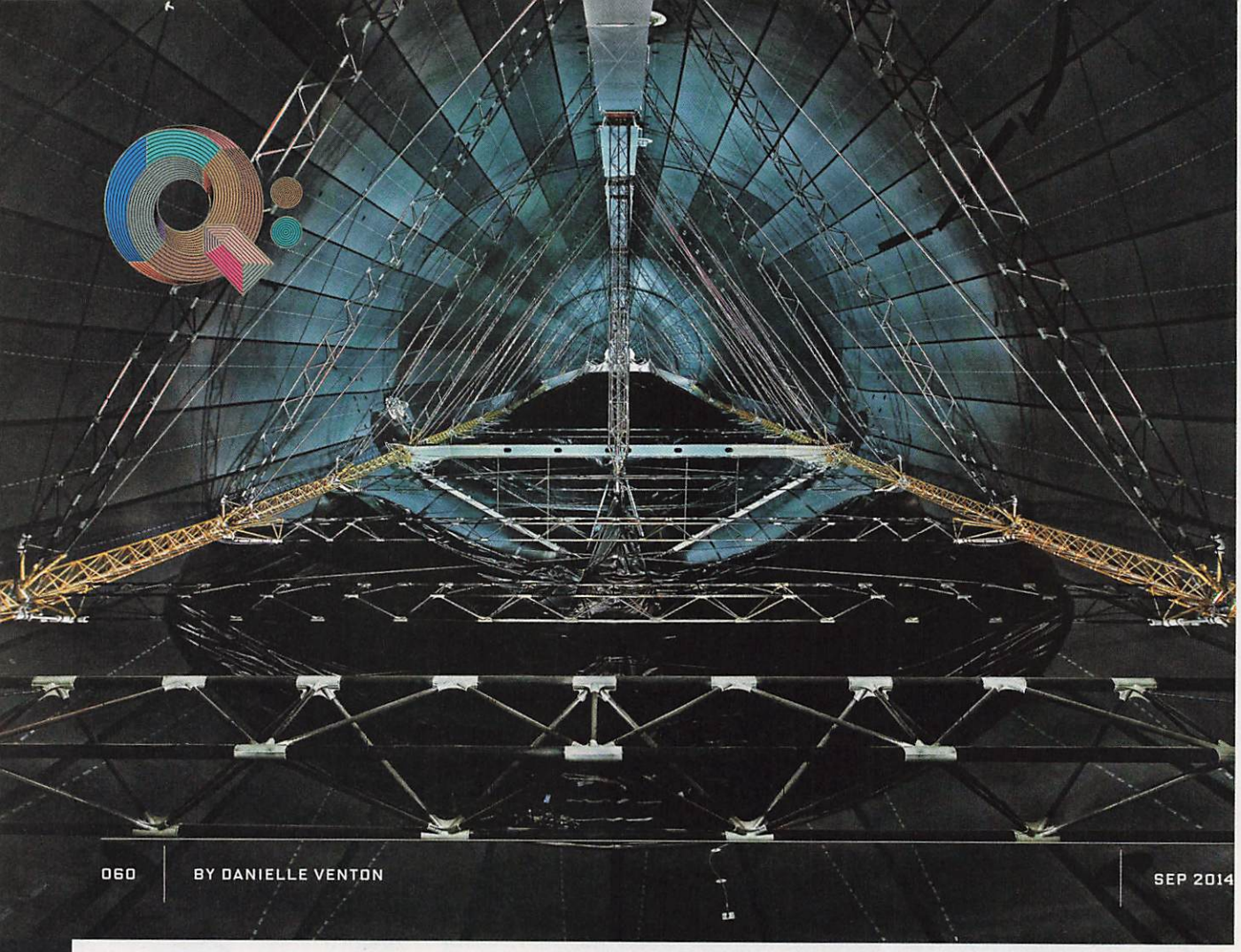
THE ALL-NEW GMC YUKON DENALI. THAT'S PROFESSIONAL GRADE.

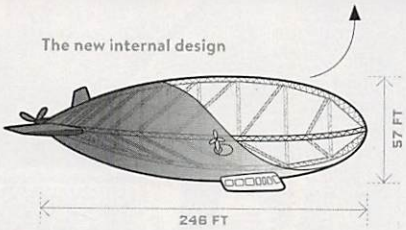
GMC

WE ARE PROFESSIONAL GRADE

Preproduction model shown. Actual production model may vary. *Available in vehicles produced starting fall 2014. See dealer for vehicle availability. Visit onstar.com for details and system limitations. Services vary by model and conditions. Requires active OnStar subscription and data plan. ©2014 General Motors. All rights reserved. Denali® GMC® Magnetic Ride Control™ OnStar® WE ARE PROFESSIONAL GRADE® Yukon®

Connected by On 4G LTE





BEYOND BLIMPS THE AIRSHIP'S NEXT ACT

IN AUGUST, Goodyear launched a new blimp—and it can do a lot more than cruise over the Super Bowl. This dirigible incorporates some of the innovations that airship makers have been promising for a decade: a combination of speed and fuel efficiency that should make lighter-than-air crafts the future of shipping, travel, and even disaster response. ¶ Codesigned by Luftschiffbau Zeppelin, Goodyear's new model combines the best elements of blimps (bags full of helium) and zeppelins (with rigid bodies). The resulting hybrid has a lightweight endoskeleton that frames out an inflatable 1.5-millimeter-thick polyester envelope. That structure maintains an aerodynamic shape and serves as a mount for its three engines. Old blimps, whose engines dangled from the gondola instead, needed forward momentum to take off and stay in the air. But pivoting engines fixed on the tail and either side of the ship mean this one can hover like a helicopter. ¶ That dexterity, now co-opted by builders less storied than Zeppelin, means today's airships can do much more than preside over sports events. They can drop aid to remote areas when disaster strikes—no runway needed. And that semi-rigid construction means dirigibles will just get bigger and bigger. The world's largest airship is over 300 feet long, and builders tout future ships of more than 600 feet, large enough to carry twice the freight of a 747 using a fraction of the fuel. The cash from that ad slapped on the side? That's just gravy.

COURTESY OF BERNHARD GEHRING; ILLUSTRATION BY BROWN BIRD DESIGN

DATASTREAM // THE MOST CONTROVERSIAL BOOKS OF 2013, BY BAN REQUESTS

CAPTAIN UNDERPANTS (SERIES) // THE BLUEST EYE // THE ABSOLUTELY TRUE DIARY OF A PART-TIME INDIAN // FIFTY SHADES OF GREY // THE HUNGER GAMES // A BAD BOY CAN BE GOOD FOR A GIRL // LOOKING FOR ALASKA // THE PERKS OF BEING A WALLFLOWER // BLESS ME, ULTIMA // BONE (SERIES)

SIEMENS

©Siemens AG, 2014. All Rights Reserved.

Farming wind in Iowa and powering America's future.

Siemens is helping wind power become a significant part of the U.S. energy mix.

The energy landscape is changing. Siemens is committed to advancing America as a leader in wind energy. In a massive undertaking, Siemens is partnering with local energy providers to expand the scope of wind power in Iowa by adding hundreds of new wind turbines. Once completed, the additional turbines will make up a substantial part of the region's energy mix—capable of powering over 320,000 homes.

Economic opportunities are also blowing in. The growth in wind energy helps support hundreds of manufacturing, construction, and maintenance jobs, bringing prosperity to communities across Iowa—and across America. A new era in American energy has arrived.

Somewhere in America, Siemens is building answers that will make a difference in our lives.

siemens.com/answers

MR. KNOW-IT-ALL

SPOUSAL SPATS

What's the best messaging tech to use when I'm angry at my spouse? Text, email, phone call, Snapchat, Facebook?

IN 1938 a young academic named Marshall traveled from St. Louis to California, where he visited his overbearing mother. She introduced him to a woman named Corinne; Marshall's mom had recently gotten to know Corinne and decided that Marshall should marry her. It must have been awkward, but Marshall and Corinne hit it off well enough to start writing letters.

It was courtship by mail—but not the most satisfying one. Marshall "was not a man who was in love with being in love," a biographer would later write. In fact, he openly mocked the idea of romance in his letters to Corinne, snidely explaining that he would not be writing her any poems or rhapsodically "celebrating your perfections, real, dubious and imaginary." But Corinne *wanted* romance; she wanted something a little more sensational. She sensed deep ambivalence in Marshall's letters, and that must have made her feel ambivalent too, because when Marshall decided—in his own painfully left-brained way—that he ought to marry Corinne and proposed to her in one of his letters, she demurred. So Marshall proposed again. And again. And five or six more times after that.

Did Corinne feel annoyed? Angry? Scared? And what if this had all happened 70 years later—if, early in their correspondence, Corinne had been able to text her dissatisfaction to Marshall more immediately and more sharply? What if she'd had Snapchat? Or Twitter? Would Marshall have immediately understood his shortcomings as a suitor and become more affectionate? Or would that pointed, immediate criticism have made him message her right back in a defensive way, thus launching a heated back-and-forth from which their relationship could never recover? Would that have been better than all these letters? No, probably not. Because the truth is, Corinne and Marshall did eventually marry. They had six children and, for the most part, lived happily ever after.

Now, your question is fundamentally about how technology affects communication. And, as it turns out, Marshall wound up thinking a lot about this question. He became very famous for thinking about it, actually, and for explaining it this way: "The medium is the message." (Marshall's last name was McLuhan.) He also wrote that "one of the effects of speedup of information-movement of all kinds ... is that the moment of impact and the moment of response are the same. There's no gap, no time-lag anymore ... You don't have any nice, comfortable period in which to think about it"—to reflect before responding. When we feel compelled to communicate quickly, we all just end up vomiting raw emotion at each other.

I could be reading McLuhan all wrong—frankly, a lot of his work is over my head—but I think what he's saying here is people need time to figure out how they feel. And that's an argument for telling your spouse you're mad at them via a technology that allows for, or even encourages, that kind of reflective pause before responding. So not a phone call. But also not texts or Snaps, because we're accustomed to firing back replies to those instantaneously. I think email is the way to go; it's our clearest equivalent to the old-fashioned letters Marshall and Corinne exchanged. W

What a Smart Ass™ Fan

Introducing the Haiku® ceiling fan with SenseME™ technology. Now the world's quietest and most energy-efficient ceiling fan is also the smartest.

Forget the Switch

SenseME knows when you enter or leave a room, turning Haiku on and off automatically.

Forget the Pull Chain

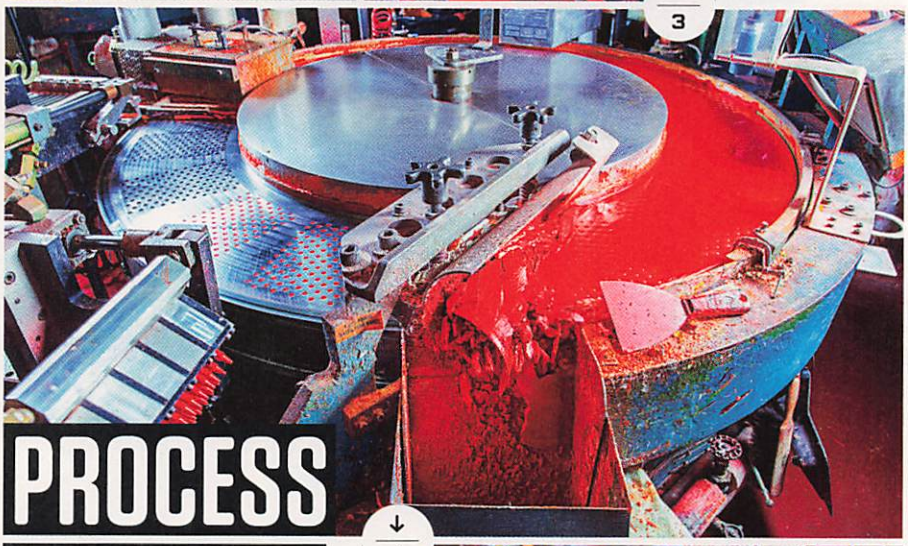
SenseME monitors the room's temperature and humidity, adjusting Haiku's speed when conditions change.

Forget Discomfort

SenseME learns your comfort preferences, tailoring those speed adjustments to what you find comfortable.

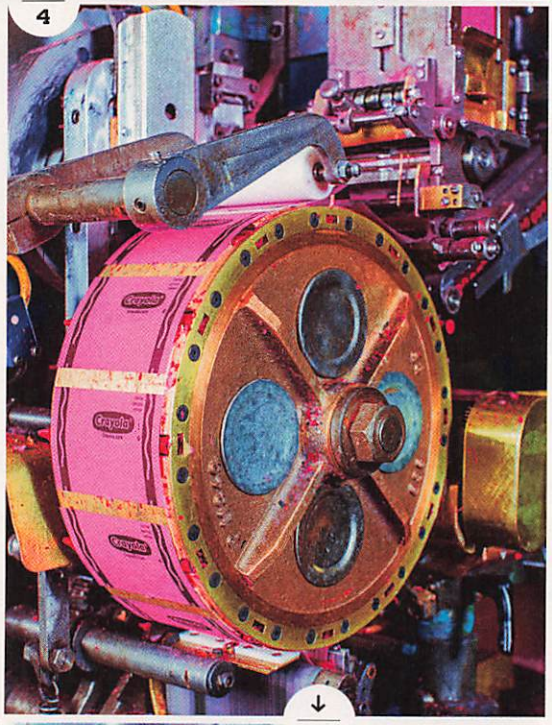
To receive a Haiku info kit call 888-958-0120 or visit **bigassfans.com/smartass** and enter **WD914**.

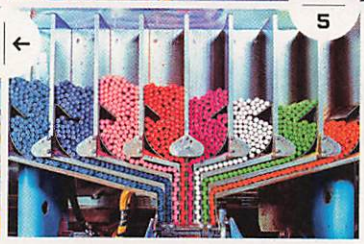
BIG ASS FANS
No Equal

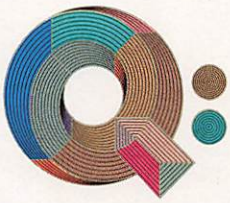


PROCESS CRAYOLA CRAYONS

THE FIRST BOX of Crayolas rolled off the production line 101 years ago, and today the company's Easton, Pennsylvania, factory turns out 12 million crayons a day. "We maintain the process as though we were making food," says Dave Farkas, manager of manufacturing quality assurance at the plant. Makes sense, given how likely its consumers are to put the product in their mouths. Here's how Crayola makes the iconic (but inedible) color sticks.







1 | MELT

Twice a week, railcars full of uncolored paraffin wax pull up to the factory. An oil-filled boiler heats the cars with steam, and workers pump the now-molten glop into a silo. Each silo holds up to 100,000 pounds of wax, and the plant empties a silo nearly every day.

2 | MIX

From the silos, the wax moves through pipes to the mix kettles. Operators add a strengthening additive and dump in a bag of powdered pigment. The amount varies by the saturation and opacity of the color—yellow requires only a few pounds per 250-pound batch; black requires a lot more.

3 | POUR

Pumps move the newly colored liquid into a flat-topped, water-cooled steel rotary mold with 110 crayon-shaped cavities. An ejection station spits out the crayons, and a robotic arm carries them to the labeling operation.

4 | LABEL

The crayons feed into a big metal drum, where they get labels and adhesive. Then the crayons are stored by color in inventory boxes.

5 | PACK

ROYGBIV colors come off the line every day, but exotics—periwinkle, say—must wait until the factory is making larger packs. Then operators feed the sticks into funnels, which drop one of each color onto a platform so a mechanical arm can sweep them into a box.

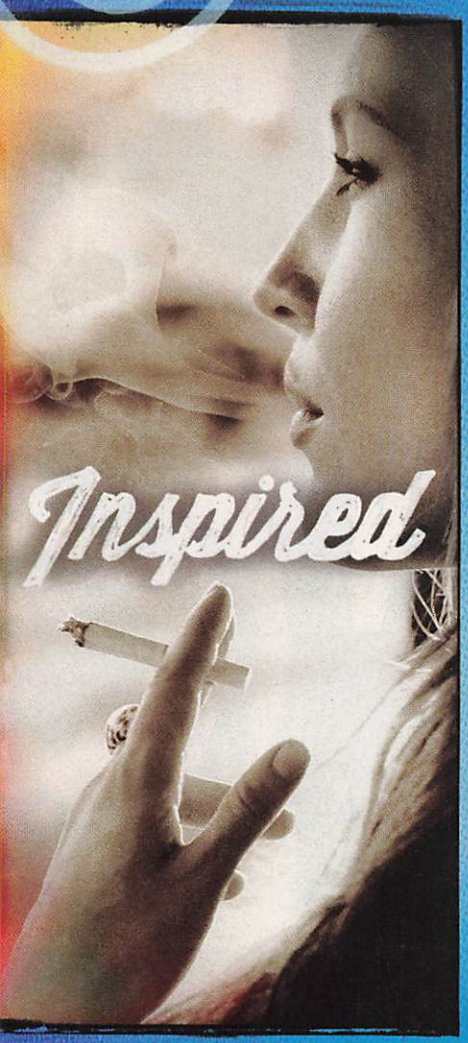
6 | SCAN

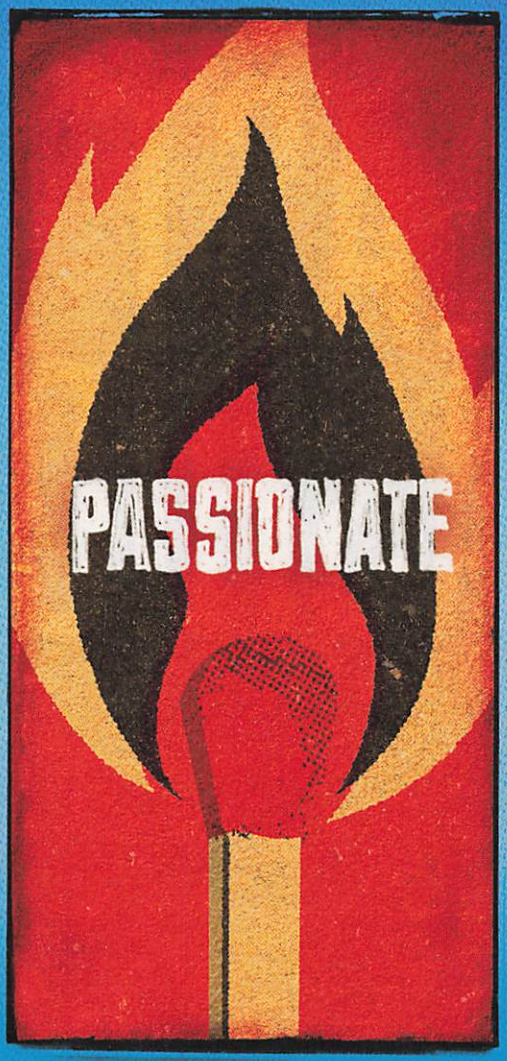
A laser etches a date code on the cardboard, and a metal detector makes sure nothing but crayon is inside. Then, robotic packing machines bundle the boxes onto pallets, or into the cardboard display cases that await lucky kids in the school supplies aisle.

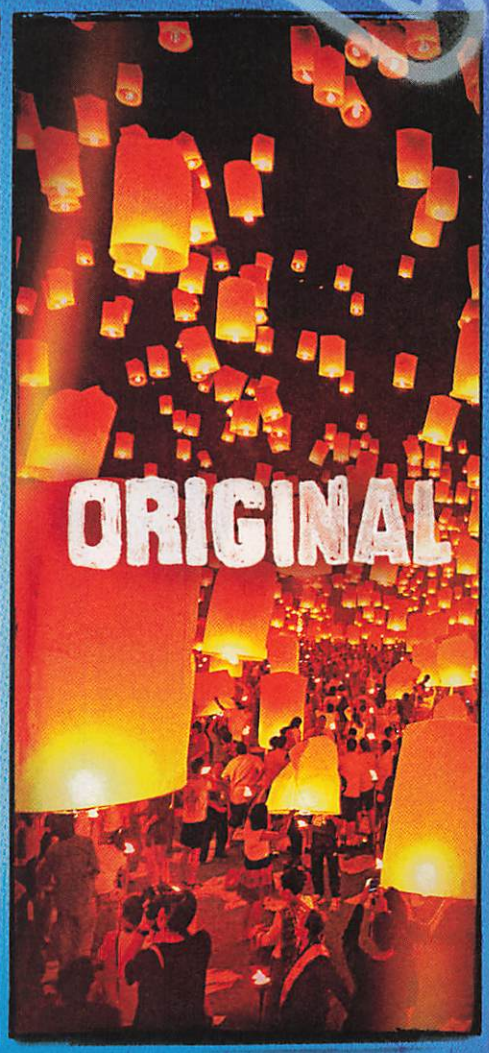
CIGARETTES

©2014 R.J. REYNOLDS TOBACCO CO.

CAMEL







TASTE IT ALL

SURGEON GENERAL'S WARNING: Smoking Causes Lung Cancer, Heart Disease, Emphysema, And May Complicate Pregnancy.

ADVERTISEMENT

bon appétit
FEAST OR FASHION

FEAST OR FASHION

FASHION ALL DAY. FOOD ALL NIGHT.

Bon Appétit's Feast or Fashion celebrates the most acclaimed chefs, restaurants, and noteworthy names in fashion during New York's most buzzed about week.

KICKING OFF the festivities is *BA*'s Hot 10 Party in honor of America's Best New Restaurants, followed by intimate chef and designer dinners at the city's chicest venues.

NEW FOR 2014: *Bon Appétit* has partnered with I KNOW THE CHEF to provide on-demand VIP experiences and exclusive access to special Feast or Fashion menus at hot spots throughout the city.

PRESENTED BY

ALL-CLAD | ALL-NEW 2015 FORD MUSTANG | ESSIE | FERRARI-CARANO WINERY | LIEBHERR
MAYBELLINE NEW YORK | MOUNTAIN VALLEY SPRING WATER | REVEAL CALVIN KLEIN | STRIVECTIN

bon appétit

BAFeastOrFashion.com

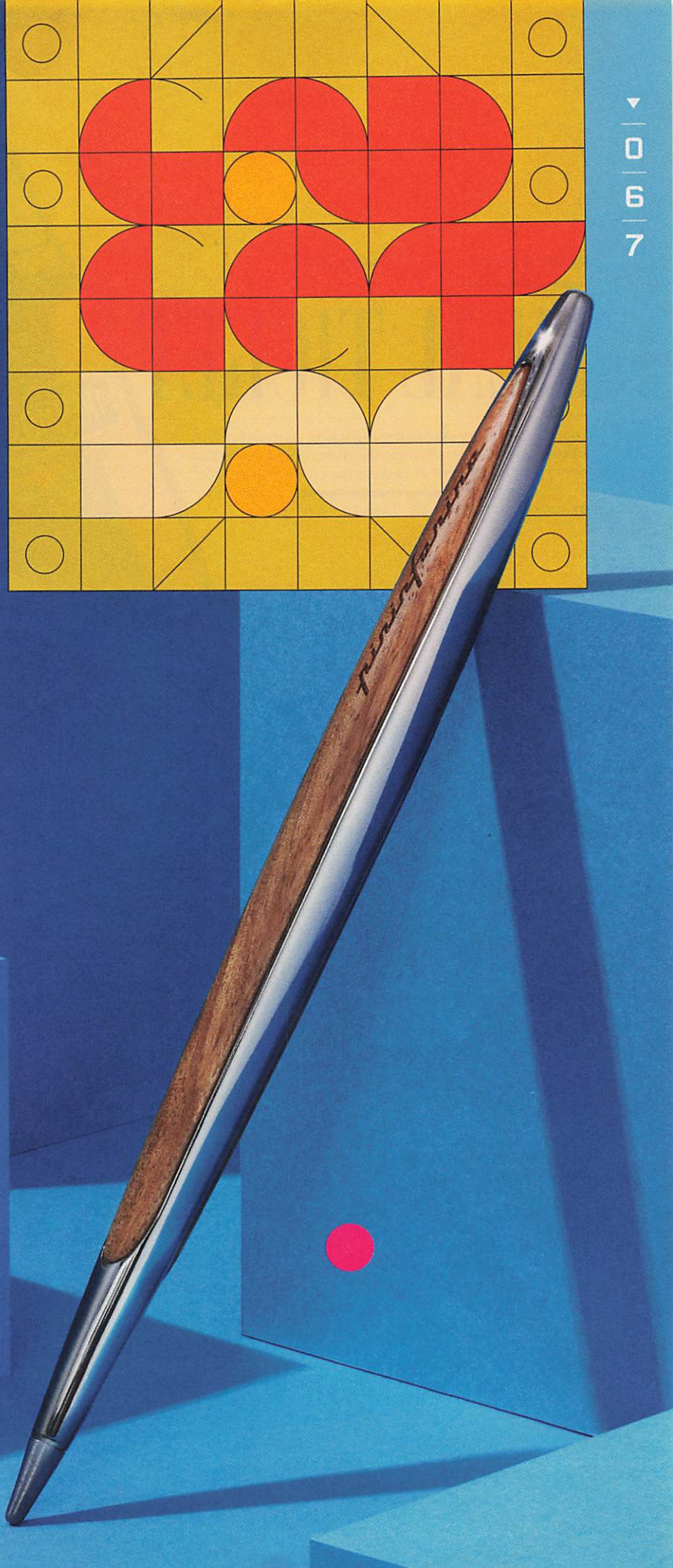
FETISH | $120

NAPKIN 4.EVER
PININFARINA CAMBIANO

MISSING INK

Italian design firm Pininfarina—famous for shaping such iconic Ferraris as the Daytona and the F40—is now applying its automotive eye to the world of high-end writing instruments. The wood and aluminum Cambiano pen, made in partnership with Napkin, takes both its name and its visual cues from Pininfarina's latest concept car, a plug-in electric with a range of 500 miles. But this sleek stylus can go forever without filling up: Rather than transferring anything to the page, the alloy tip makes its mark by oxidizing the paper it touches. You can use it to write an entire novel—or even a six-volume set. Your hand will give up before the Cambiano does.

BY BRYAN GARDINER | SUN LEE



HEAD-TO-HEAD | LUNCHBOXES

MEAL TICKET

Lunchbox wizardry used to mean packing your juice pouch to keep your apple from smooshing your PB&J. Today's carriers are built for more discerning appetites. Bon appétit!

BY NICK STOCKTON | JARREN VINK

1 | BENTGO

BEST FOR: OCD epicures looking for order in the transport of their three-course meals.

Even if lunch is last night's unwieldy takeout, the Bentgo will provide suitable accommodations. A full set of plastic utensils—fork, knife, and spoon—snaps into the divider lid, and the top tray is partitioned to keep your veggies from infiltrating your dessert. Just don't pack anything too juicy: The lids keep your bag safe from your green beans, but soup will seep out.

$15

2 | THERMOS STAINLESS KING FOOD JAR 16 OZ.

BEST FOR: Eaters who like their calories hot and are cool with slurping in public.

A spoonful of soup can do miracles for midday stress, and the vacuum-insulated, double-walled King will keep your goulash hot for up to seven hours. The design is compact and complete, with a built-in spoon and a lid that doubles as a bowl. Cleaning the widemouthed Thermos is easy, but make sure soup crust doesn't build up in the spoon's articulated joints.

$25

IF YOU CAN HOLD A PHONE YOU CAN HOLD A MEETING

GoToMeeting
by CITRIX

GoToMeeting is dependable, easy to use and works on a Mac, PC, smartphone or tablet. Your next meeting, close at hand.

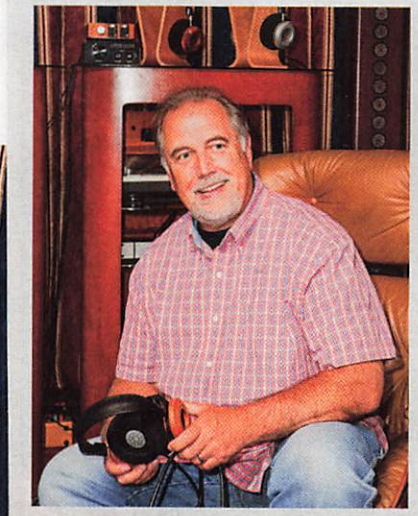
Try it free for 30 days. | gotomeeting.com

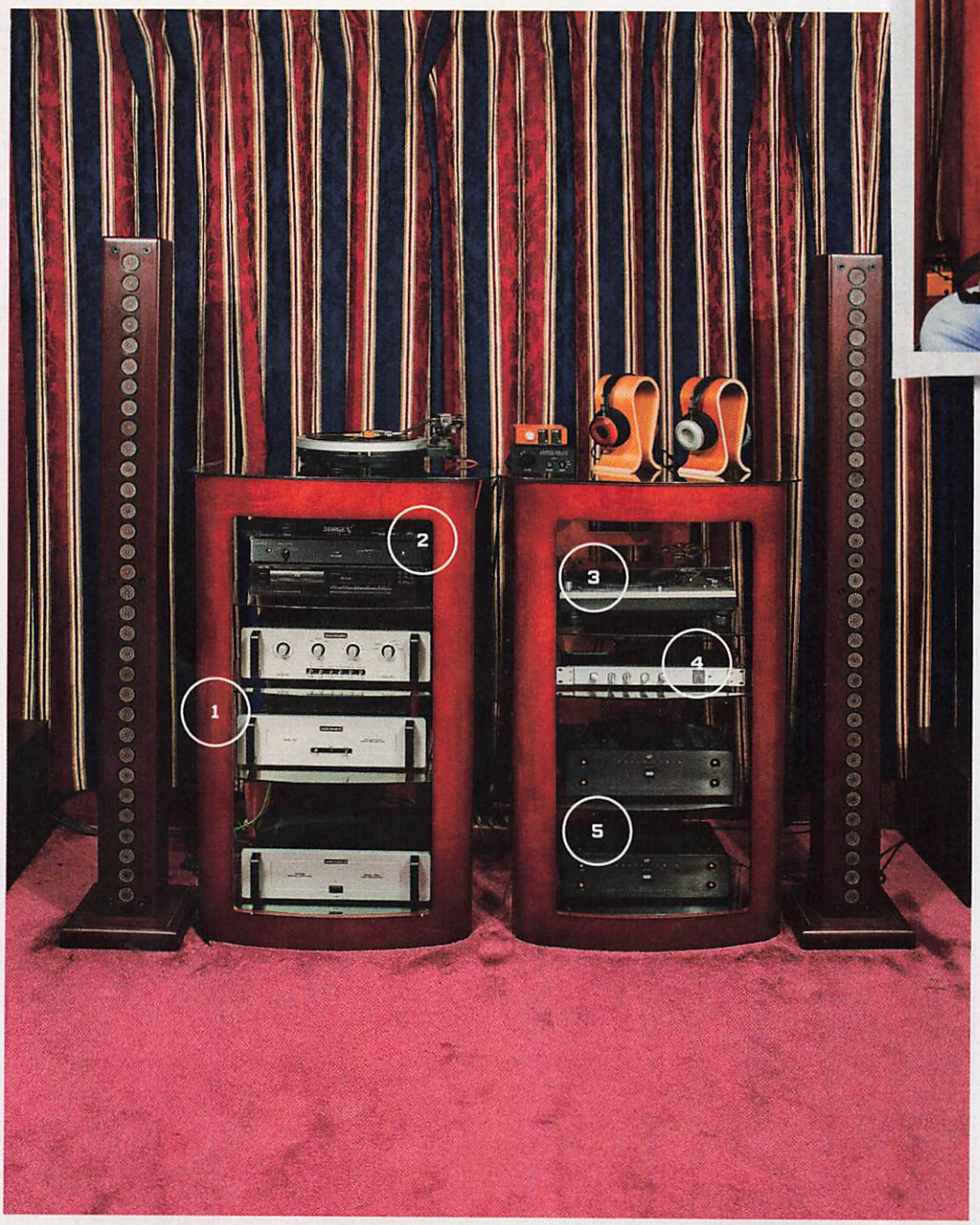
©2014 Copyright Citrix Systems, Inc. All rights reserved. GoToMeeting is a trademark of Citrix Systems, Inc., or a subsidiary thereof, and is or may be registered in the U.S. Patent and Trademark Office and other countries. All other trademarks are the property of their respective owners.

THE SONIC ROOM

Smart people know that Sunset Park is where you get the best Chinese food in Brooklyn. *Really* smart people know it's also where you get great headphones—some of the best in the world. The Grados have been making audiophile-grade cans in the same building since 1955. What was the family produce mart is now a factory, and through the graffitied doors is the listening room, where company president John Grado (right) uses a special hi-fi stack to tune every headphone his company makes.

BY JOE BROWN | JEREMY LIEBMAN

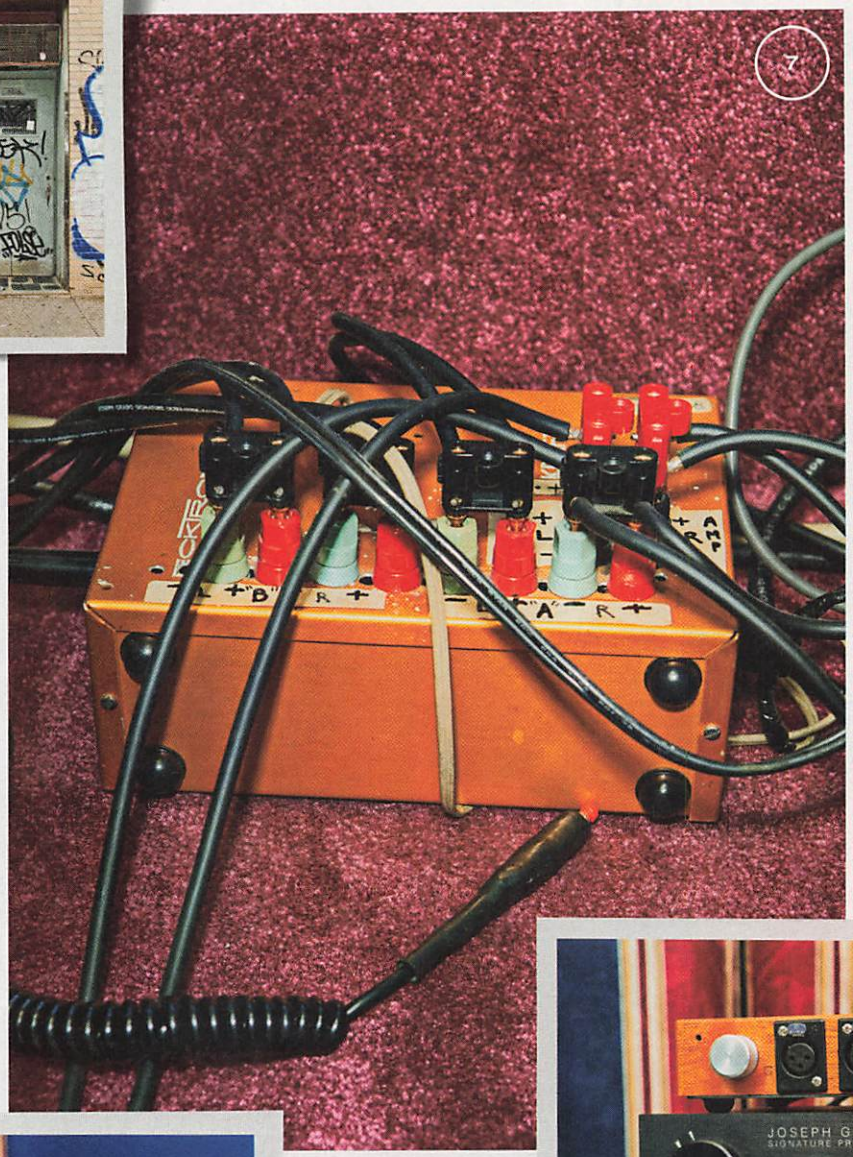




1. THE TUBE STACK
Grado's system has two distinct halves: a tube side and a solid-state side. The tube bank is all Audio Research gear: an LS25 preamp, a PH3E phono stage amp, and a 100.2 power amp. "None of this gear is stock," Grado says. The engineers at Audio Research souped it up for him.

2. FORTE F 50A DA CONVERTER
This translates the signal coming out of a CD player (he has a Rotel RCD-965BX) or other digital source into an analog wave that an amplifier can turn into sound.

3. TECHNICS SL-1200 MK5 TURNTABLE
"That's the workhorse," Grado says of the discontinued record player.



4. THRESHOLD FET NINE PREAMP
The preamp is the junction of your audio system, and a great one—like the FET Nine—shouldn't do much more than pipe sound from source to amp without announcing its presence.

5. FORTE MODEL 7 MONOBLOCKS
Serious solid-state stereos often use a separate amp on each channel to prevent interference. Each of these twin beasts from the '90s can crank out up to 225 watts per channel.

7. SWITCHER BOX
One of Grado's engineers wired this up. No matter what source you're playing, hit a button and the system switches from tube to solid-state or vice versa. Grado uses it to ensure the phones are technology-agnostic.

8. BALANCED HEADPHONE AMPLIFIER
Balanced headphones use an individual ground wire for each channel. Grado will balance any of its cans for $150, but it gets only a few requests a year. They made this amp in house to test them.

6. "THE GRADO TOWERS"
John Grado designed these speakers to use 32 stacked headphone drivers. They never made it to production, because a glowing review of the company's SR60 headphones came out and business took off. "We couldn't make things fast enough."

9. MICRO SEIKI DQX-500
This '80s turntable is special on its own, but Grado's is outfitted with a tone arm designed by Joseph Grado—the company's founder and John's uncle—as well as a prototype high-end cartridge that's set for production in 2015.

STOCK OPTIONS

Those penny shares aren't going to pick themselves. Use these financial tools to stay informed—and ready to move—at all times.

BY BRYAN GARDINER | PEDEN + MUNK

iOS | ANDROID

LEARN

YAHOO FINANCE Track real-time performance of any stock or index. For more in-depth analysis, flip your phone sideways and sift through vast amounts of data on any company you choose. **FREE**

BLOOMBERG+ Smart investing means staying in the know. Read breaking news in this app, and create custom stock watch lists to track and analyze personal holdings. **FREE**

PRACTICE

STOCK WARS: VIRTUAL INVESTING Test out new strategies before implementing them in the real world, and do it with real-time urgency. Compete with friends to see who's the biggest wolf. **FREE**

STOCK MARKET SIMULATOR PLUS Wall Street is intimidating, particularly for newbies. Hone your skills by building and tracking your virtual portfolio in this stock market simulator. **$2**

TRADE

TD AMERITRADE MOBILE Like other apps, this one lets you track, buy, and sell. Unlike other apps, you can use it to scan a barcode and look up the public company behind the product. **FREE**

E-TRADE MOBILE Easy-to-use interface for executing trades quickly. Use voice search to find specific stocks or company data. Move money into and out of your bank account inside the app. **FREE**

WIN

STOCKTOUCH Greed is good. Heat maps are better. StockTouch uses color-coded maps of the top stocks in the major sectors to help you understand the ups and downs of the market. **FREE**

STOCKTWITS It's Twitter for traders. Get minute-by-minute insights from fellow investors. A Sentiment Indicator shows members' bullish- or bearishness on any specific asset. **FREE**

LOOK UP.

We looked to the sky and saw a different way to purify water. By vapor-distilling it, so it's pure and crisp like from a cloud, then adding electrolytes for a distinct taste. Oh, and we got some daydreaming done, too.

What will you see when you look up?

GLACÉAU smartwater

drinksmartwater.com

©2014 glacéau. glacéau®, smartwater®, bottle design and label are registered trademarks of glacéau

VISIT US ONLINE AT WIREDINSIDER.COM + FOLLOW @WIREDINSIDER ON TWITTER + LIKE WIREDINSIDER ON FACEBOOK

imprint® Comfort Mats

COMFORT FOR BODY AND SOLE®

You'll love standing on an Original Imprint® Anti-Fatigue Comfort Mat. Give your yourself - or your staff - all-day cushioning comfort with the CumulusPRO™ Commercial Grade Series. #1 Rated Standing Desk Anti-Fatigue Comfort Mat!!

There's an Imprint® Mat for every home, workplace and workspace!!

SAVE 20%

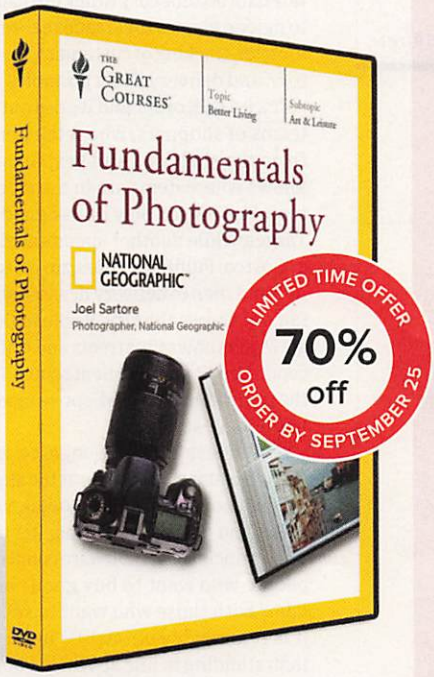
PLUS FREE SHIPPING

Use promo code W20 • Offer expires 12/18/2014

imprintmats.com • 1-800-655-MATS

100% Satisfaction Guarantee

Lifetime Unconditional Returns



Learn the Inside Secrets of Professional Photographers

NATIONAL GEOGRAPHIC™

Photographs can preserve cherished memories, reveal the beauty of life, and even change the world. Yet most of us point and shoot without really being aware of what we're seeing or how we could take our photos from good to great.

Just imagine the images you could create if you were trained to "see" as the professionals do. With **Fundamentals of Photography**, you'll learn everything you need to know about the art of taking unforgettable pictures straight from photographer and National Geographic Fellow Joel Sartore—a professional with over 30 years of experience. Whatever your skill level, in these 24 engaging lectures you'll learn to hone your photographer's eye, take full advantage of your camera's features, and capture magical moments in any situation or setting imaginable.

Fundamentals of Photography

Taught by Joel Sartore, Photographer, National Geographic Fellow

24 lectures on topics such as:

- Aperature
- Light
- Shutter Speeds
- Equipment
- Lenses
- Perspective
- Framing
- Editing
- Landscapes
- People
- Wildlife
- and more!

DVD INCLUDES FREE STREAMING! See website for details

Course no. 7901, 24 lectures (30 minutes/lecture)

DVD ~~$269.95~~ NOW $79.95

+$10 Shipping, Processing, and Lifetime Satisfaction Guarantee

Offer expires 09/25/14

Priority Code: 102739

Fundamentals of Photography and hundreds of other Great Courses are also available for download and streaming through our website and our FREE apps for iPad, iPhone, and Android devices.

1-800-832-2412 www.TheGreatCourses.com/4wired

THE GREAT COURSES®

For 24 years, The Great Courses has brought the world's foremost educators to millions who want to go deeper into the subjects that matter most. No exams. No homework. Just a world of knowledge available anytime, anywhere. Over 500 courses available at www.TheGreatCourses.com.

MAT HONAN

TAVIS COBURN

AT YOUR DOORSTEP

When everything is available on demand, we've entered the days of future past.

WHEN I WAS A KID, I'd walk out the front door every Tuesday and bring in glass bottles of fresh milk from our porch. Then supermarkets and single-use containers planted a dead-end sign on our milkman's route. Cold efficiency always wins, I guess; see you at Trader Joe's, vitamin D. And what happened to milk happened to all sorts of other things that once arrived at our doorstep—when was the last time your doctor dropped by for a house call? Home delivery increasingly became a quaint relic, until the pizza guy was the last man standing on the stoop. ¶ Well—*ding-dong*—it's back, as a smarter, more efficient, mobile-driven process. Everything we can conceive is going to an on-demand model, made possible by the combination of always-connected hardware and software that knows where everything and everyone is, all the time. ¶ Just look what's already possible. I can tap an icon and flowers from BloomThat are in my hands within 90 minutes. I tap another and Instacart rolls up with a bag from Whole Foods. If I don't feel like cooking, Munchery will ferry over dinner prepared by a personal chef—healthy and delicious and less expensive than the sesame beef from the Chinese place up the street. Washio will deliver my laundry. Zeel will send a masseur. Oh, damn, all that tapping made me drop my phone. No problem, iCracked will rush right over to fix my shattered screen.

This might sound like another Silicon Valley laziness bubble, but it's more than that. On-demand service and delivery is booming right now because it's finally efficient to connect real-world objects and people via the Internet. It's driven by the expectation that we should be able to immediately acquire anything we want using our portable devices. If you want to hear a song or watch a movie, you fire up an app, right? This is just applying that same expectation to the physical world.

The smartphone has become an all-in-one ordering tool, payment system, and fulfillment service. It connects customers with suppliers and inventory while tracking the precise location of everyone and everything involved in a transaction. Wreck on the highway? The phone will automatically reroute your dryer sheets so you aren't paying your driver to sit in traffic. Android and iOS turned idling engines into Uber fleets and preexisting grocery stores into ad hoc distribution centers. As a result, desire is now directly linked with gratification.

Google Shopping Express may be the best example. Google has been tracking in-store inventories for more than four years to deliver local shopping results. So it already knew where stores were and what was in them. It also knew where potential customers were and what kinds of things they wanted. All that disparate data became easy to link up thanks to mobile phones that made real-time location tracking of customers, inventory, and delivery fleets possible.

Place a GSE order and it goes out to teams of shoppers, who fetch items from the shelves. (And yes, Google knows where items are in the stores too.) One person may be assigned to Target, while another spends all day at Costco. Fulfilled orders zip off to a hub and then to delivery drivers, who fan out across the city. Because Google Maps knows the streets and traffic conditions, it plots efficient routes. It's the traditional hub-and-spoke model, but Google-style.

Yet it doesn't take a Google to pull this off. Instacart will shop at the store of your choice and, unlike Google, will bring you perishable items. It's the same principle: The software connects people who want to buy goods and labor with those who want to sell it. It is remarkably efficient—more so than standing in line at Whole Foods.

Which reminds me. I've got a great idea for a new app, and you look like you could use some fresh milk. W

Email mat_honan@WIRED.com.

Hello Tomorrow

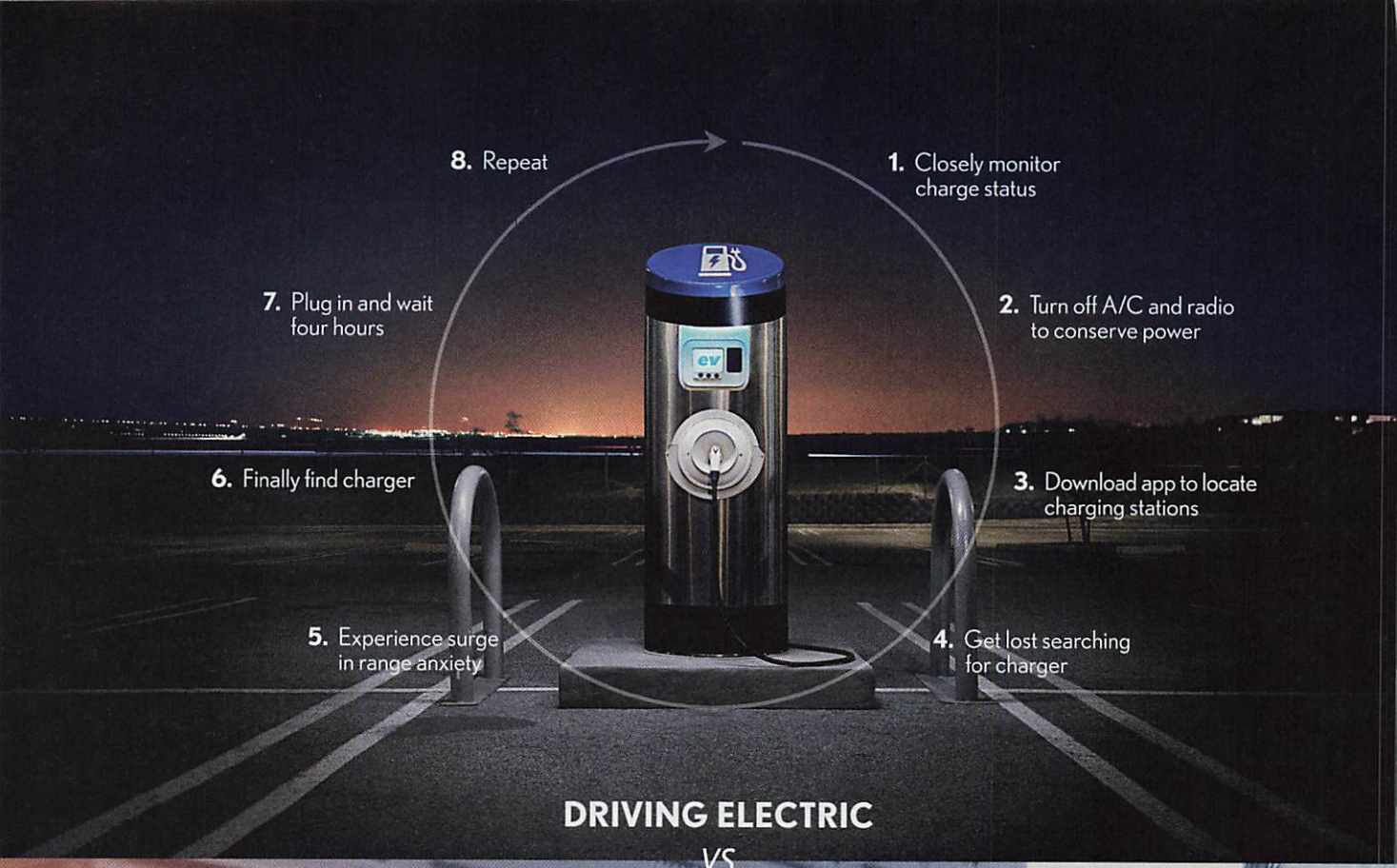
Emirates

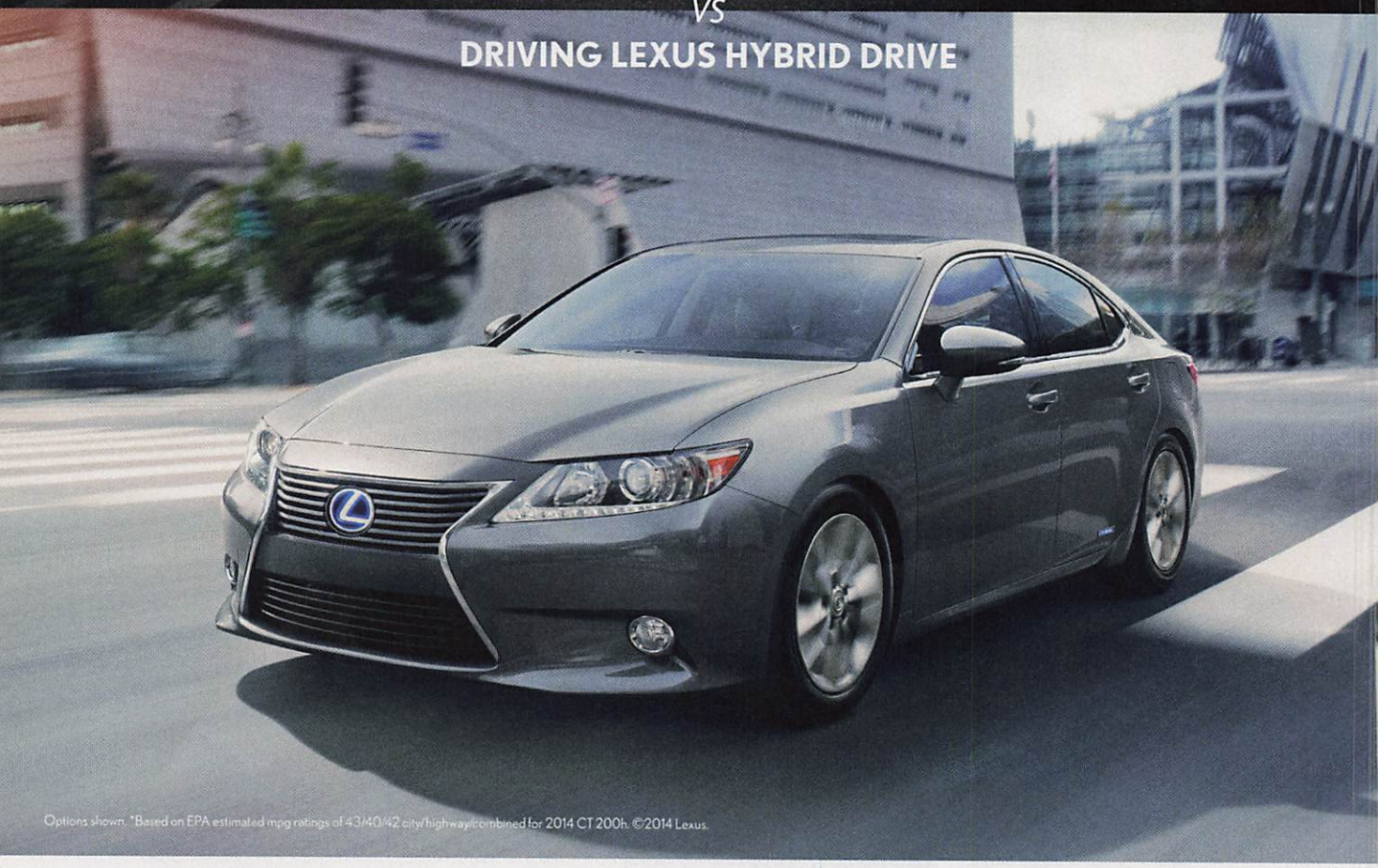
There's always more to celebrate

Settle into a seat that puts the world at your fingertips. Enjoy up to 1800 channels of on-demand entertainment, including the latest blockbusters, TV shows and games from your own personal widescreen display.

Fly Emirates to Dubai and beyond to over 140 global destinations.

emirates.com/us





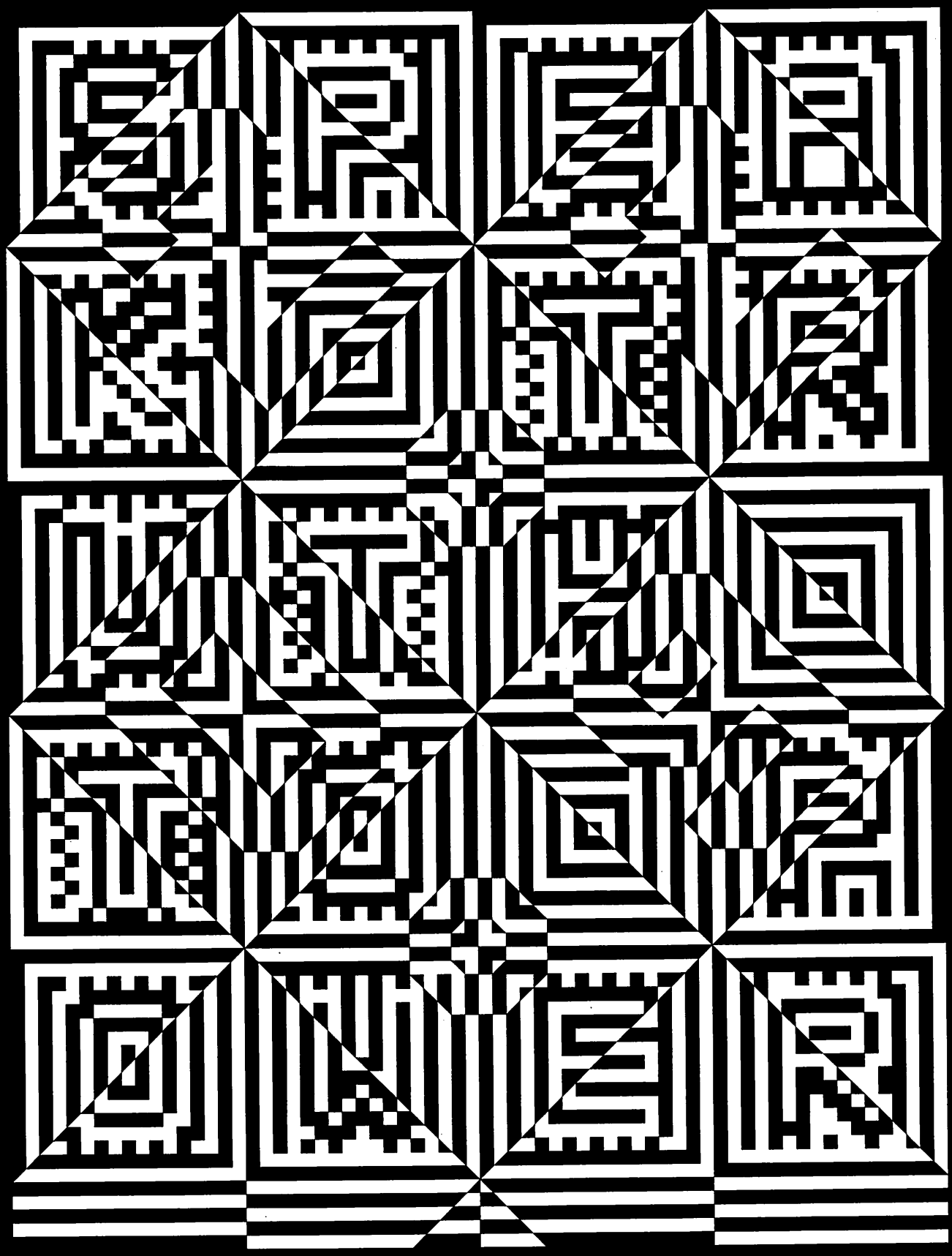
Options shown. *Based on EPA estimated mpg ratings of 43/40/42 city/highway/combined for 2014 CT 200h. ©2014 Lexus.

CHOOSE RANGE ANXIETY. OR CHOOSE THE PROVEN WAY FORWARD.

LEXUS HYBRID DRIVE is ready for whatever road lies ahead. That's because our 6th-generation hybrid technology is rated to deliver up to 42 MPG combined.* And because our technology can be used to optimize future power sources such as hydrogen or biofuel, Lexus Hybrid Drive will be as ready for tomorrow as it is today.

LEXUS
THE PURSUIT OF PERFECTION

thepowerofh.com



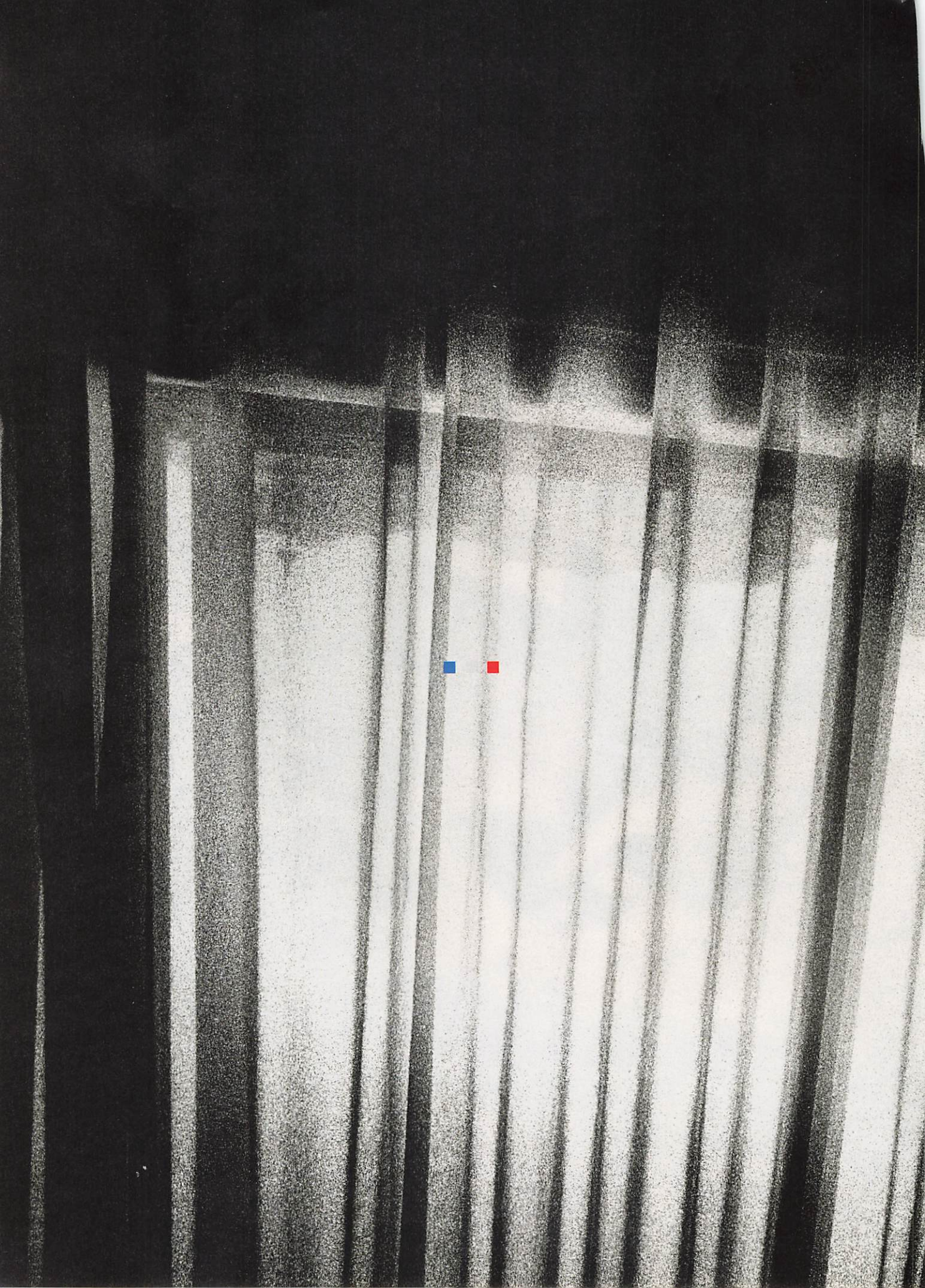
FEATURES | 22.09

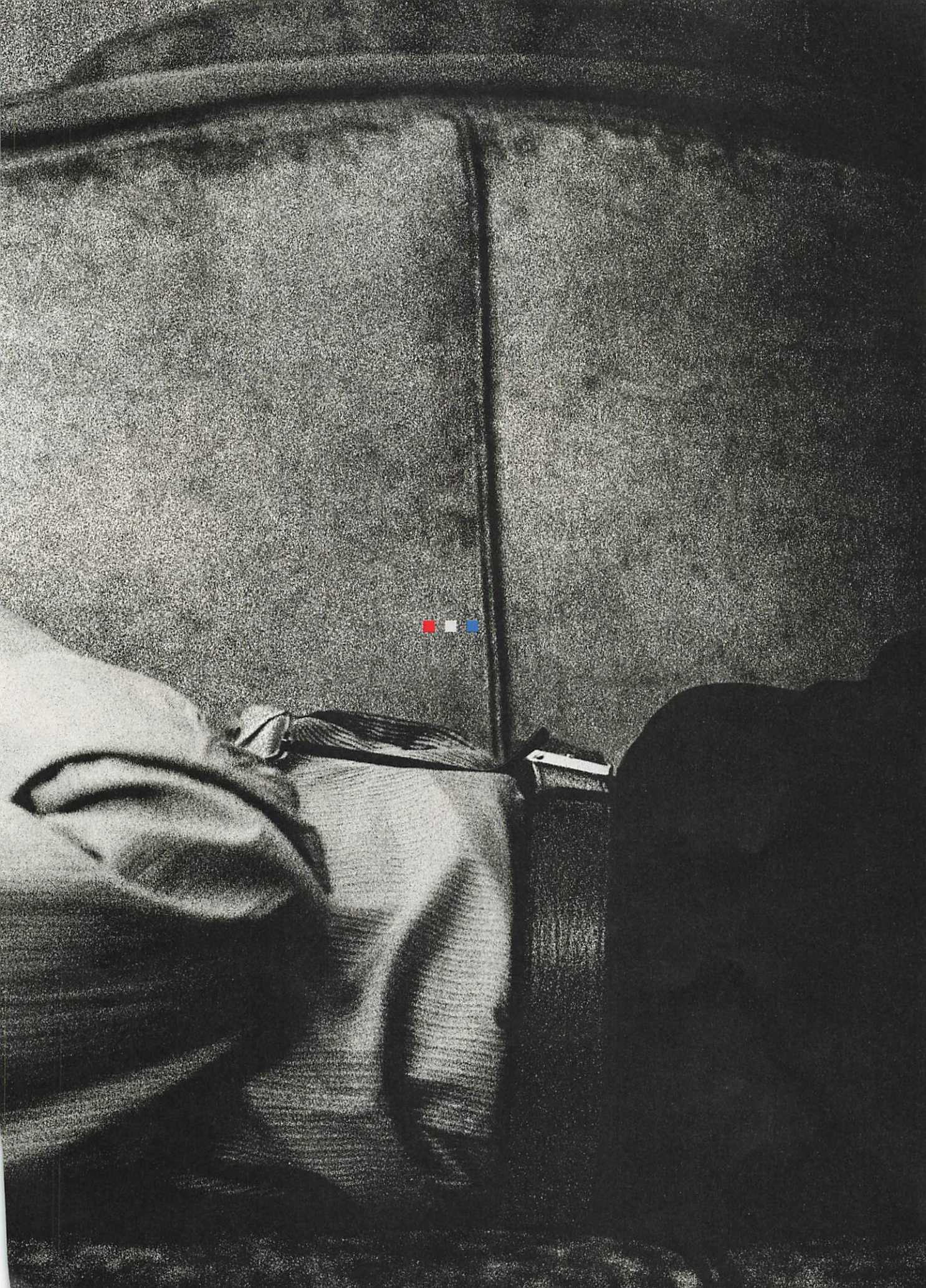
WIRED

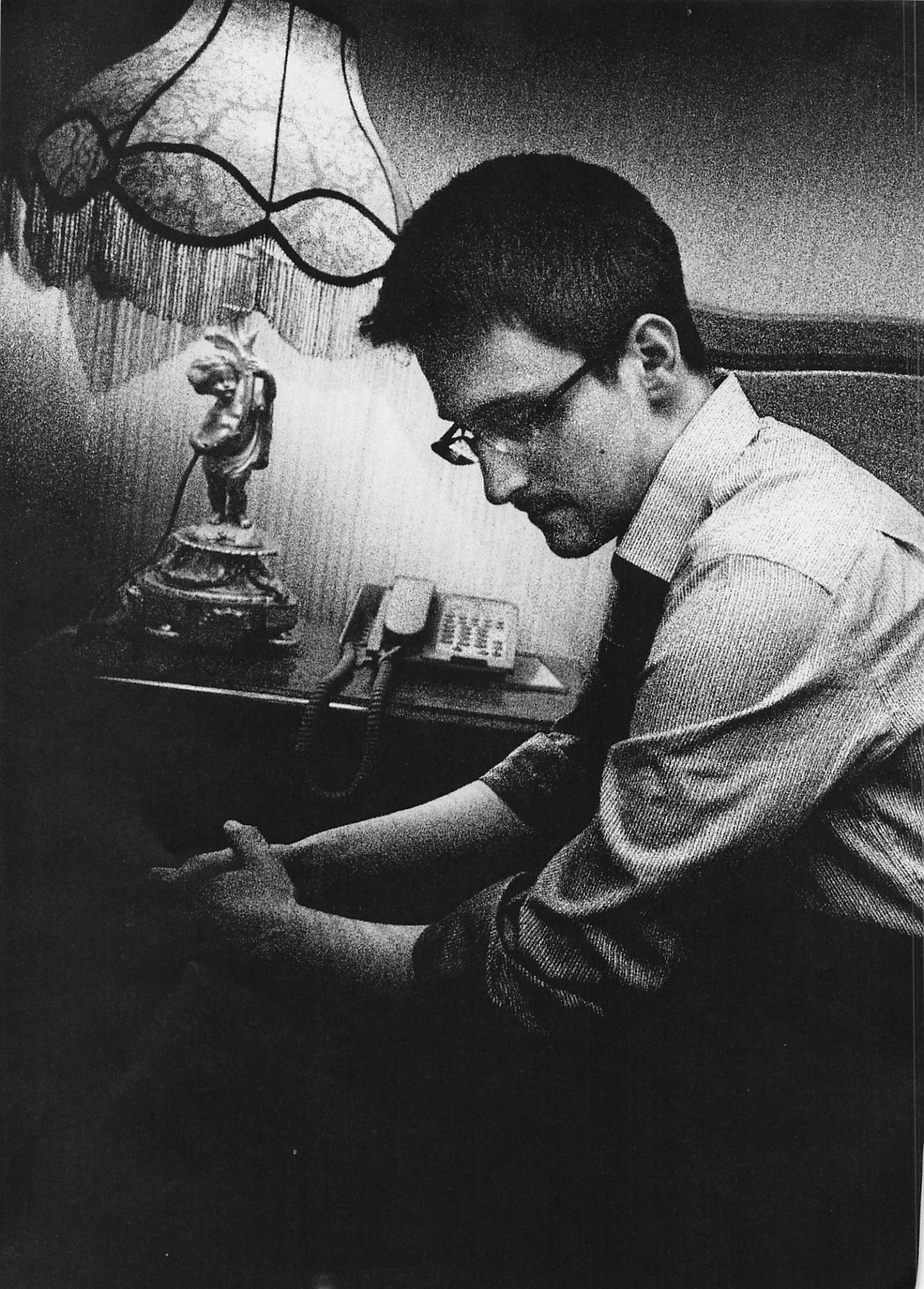
Edward Snowden 78 | Save the Net 96 | The Science of Fat 100 | Formula E 106 | The new A.I. 108 | Frank Miller 112

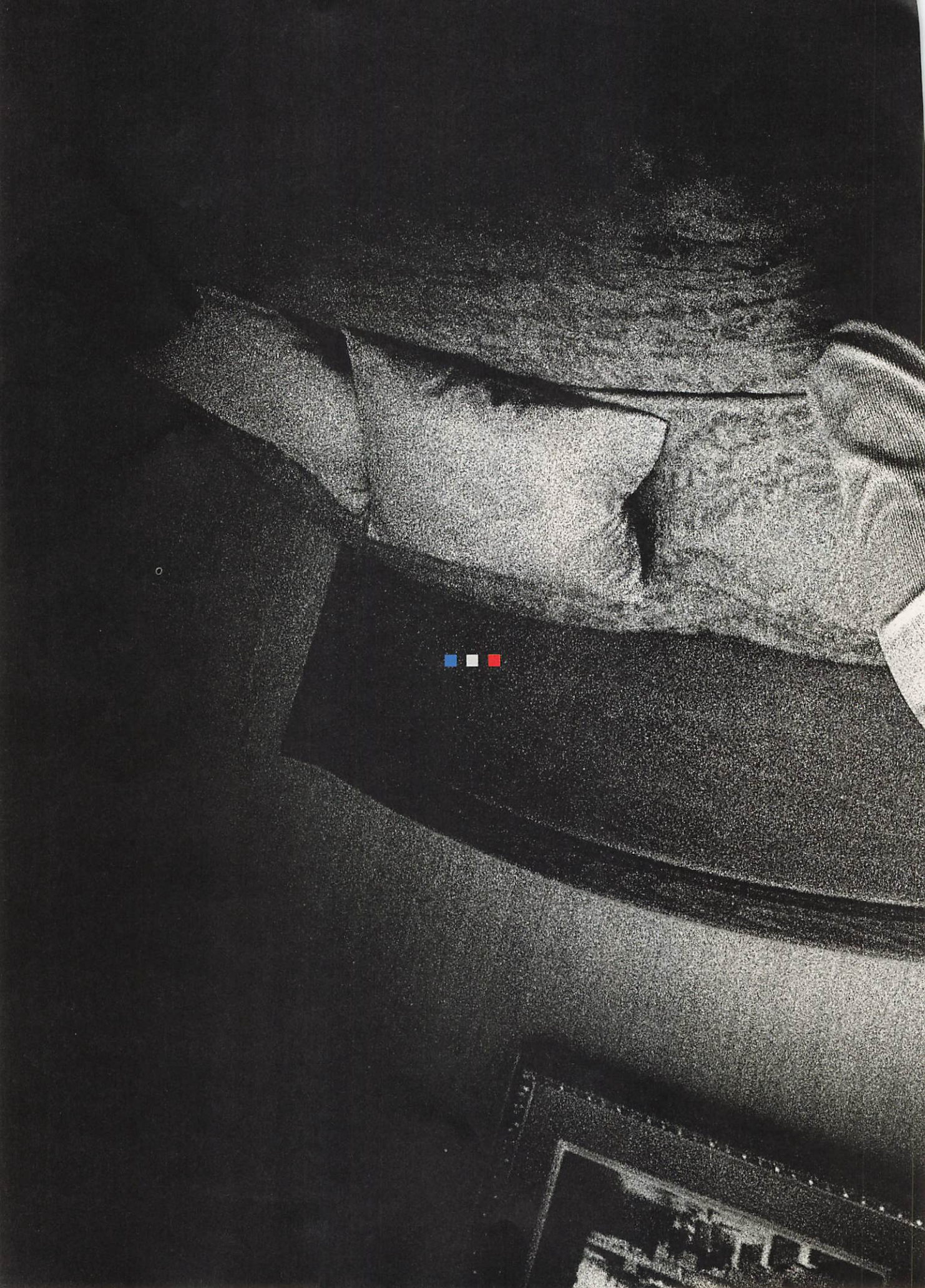
STEVEN WILSON

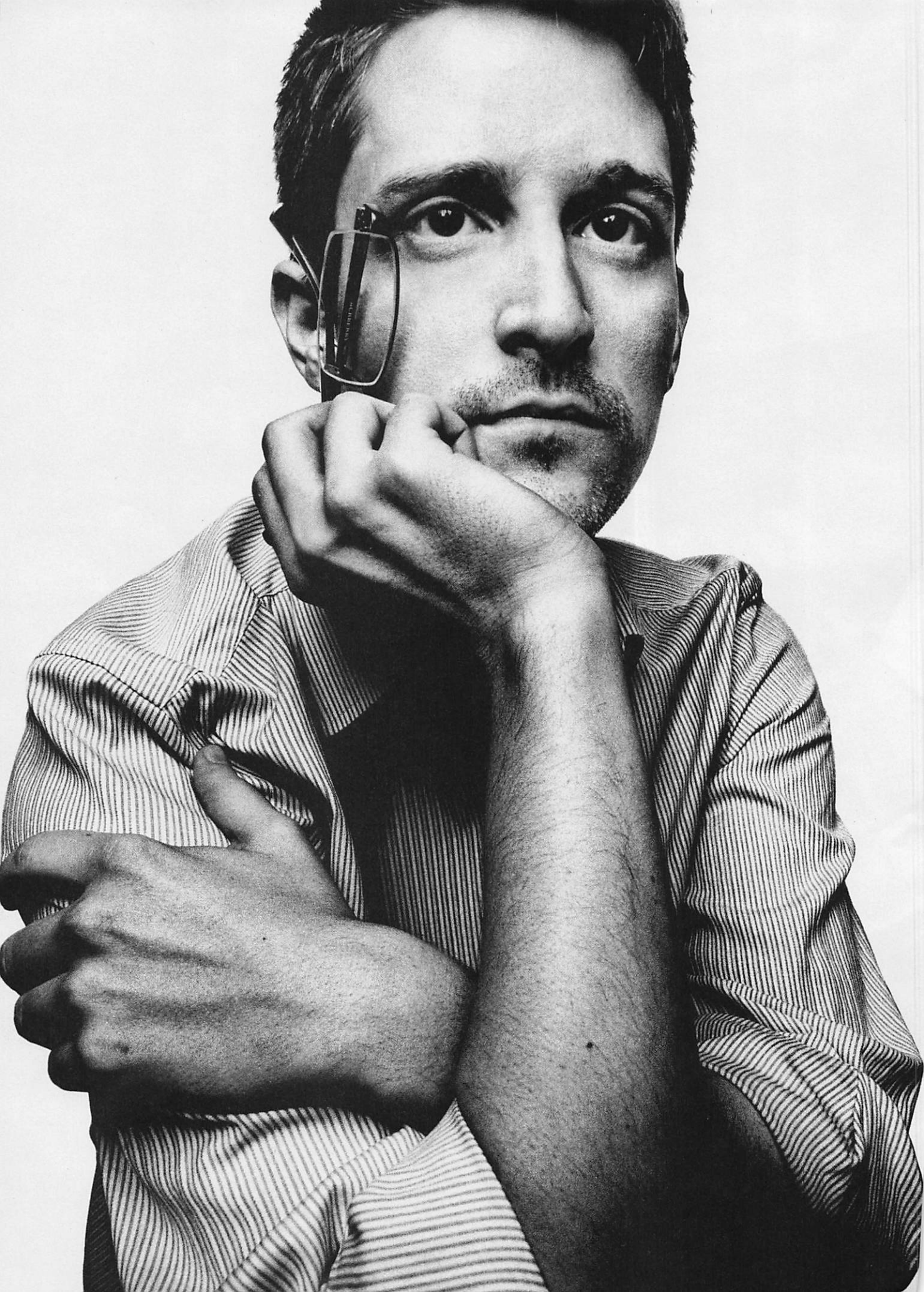
0 7 9











The most wanted man in the world

PLATON

BY JAMES BAMFORD

THE MESSAGE ARRIVES on my "clean machine," a MacBook Air loaded only with a sophisticated encryption package. "Change in plans," my contact says. "Be in the lobby of the Hotel _____ by 1 pm. Bring a book and wait for ES to find you." ¶ ES is Edward Snowden, the most wanted man in the world. For almost nine months, I have been trying to set up an interview with him—traveling to Berlin, Rio de Janeiro twice, and New York multiple times to talk with the handful of his confidants who can arrange a meeting. Among other things, I want to answer a burning question: What drove Snowden to leak hundreds of thousands of top-secret documents, revelations that have laid bare the vast scope of the government's domestic surveillance programs? In May I received an email from his lawyer, ACLU attorney Ben Wizner, confirming that Snowden would meet me in Moscow and let me hang out and chat with him for what turned out to be three solid days over several weeks. It is the most time that any journalist has been allowed to spend with him since he arrived in Russia in June 2013. But the finer details of the rendezvous remain shrouded in mystery. I landed in Moscow without knowing precisely where or when Snowden and I would actually meet. Now, at last, the details are set. ¶ I am staying at the Hotel Metropol, a whimsical sand-colored monument to pre-revolutionary art nouveau. Built during the time of Czar Nicholas II, it later became the Second House of the Soviets after the Bolsheviks took over in 1917. In the restaurant, Lenin would harangue his followers in a greatcoat and Kirza high boots. Now his image adorns a large plaque on the exterior of the hotel, appropriately facing away from the symbols of the new Russia on the next block—Bentley and Ferrari dealerships and luxury jewelers like Harry Winston and Chopard. ¶ I've had several occasions to stay at the Metropol during my three decades as an investigative journalist. I stayed here 20 years ago when I interviewed Victor Cherkashin, the senior KGB officer who oversaw American spies such as Aldrich Ames and Robert Hanssen. And I stayed here again in 1995, during the Russian war in Chechnya, when I met with Yuri Modin,

Edward Snowden, photographed in Moscow on June 13, 2014.

the Soviet agent who ran Britain's notorious Cambridge Five spy ring. When Snowden fled to Russia after stealing the largest cache of secrets in American history, some in Washington accused him of being another link in this chain of Russian agents. But as far as I can tell, it is a charge with no valid evidence.

I confess to feeling some kinship with Snowden. Like him, I was assigned to a National Security Agency unit in Hawaii—in my case, as part of three years of active duty in the Navy during the Vietnam War. Then, as a reservist in law school, I blew the whistle on the NSA when I stumbled across a program that involved illegally eavesdropping on US citizens. I testified about the program in a closed hearing before the Church Committee, the congressional investigation that led to sweeping reforms of US intelligence abuses in the 1970s. Finally, after graduation, I decided to write the first book about the NSA. At several points I was threatened with prosecution under the Espionage Act, the same 1917 law under which Snowden is charged (in my case those threats had no basis and were never carried out). Since then I have written two more books about the NSA, as well as numerous magazine articles (including two previous cover stories about the NSA for WIRED), book reviews, op-eds, and documentaries.

But in all my work, I've never run across anyone quite like Snowden. He is a uniquely postmodern breed of whistle-blower. Physically, very few people have seen him since he disappeared into Moscow's airport complex last June. But he has nevertheless maintained a presence on the world stage—not only as a man without a country but as a man without a body. When being interviewed at the South by Southwest conference or receiving humanitarian awards, his disembodied image smiles down from jumbotron screens. For an interview at the TED conference in March, he went a step further—a small screen bearing a live image of his face was placed on two leg-like poles attached vertically to remotely controlled wheels, giving him the ability to "walk" around the event, talk to people, and even pose for selfies with them. The spectacle suggests a sort of Big Brother in reverse: Orwell's Winston Smith, the low-ranking party functionary, suddenly dominating telescreens throughout Oceania with messages promoting encryption and denouncing encroachments on privacy.

Of course, Snowden is still very cautious about arranging face-to-face meetings, and I am reminded why when, preparing for our interview, I read a recent *Washington Post* report. The story, by Greg Miller, recounts daily meetings with senior officials from the FBI, CIA, and State Department, all desperately trying to come up with ways to capture Snowden. One official told Miller: "We were hoping he was going to be stupid enough to get on some kind of airplane, and then have an ally say: 'You're in our airspace. Land.'" He wasn't. And since he disappeared into Russia, the US seems to have lost all trace of him.

I do my best to avoid being followed as I head to the designated hotel for the interview, one that is a bit out of the way and attracts few Western visitors. I take a seat in the lobby facing the front door and open the book I was instructed to bring. Just past one, Snowden walks by, dressed in dark jeans and a brown sport coat and carrying a large black backpack over his right shoulder. He doesn't see me until I stand up and walk beside him. "Where were you?" he asks. "I missed you." I point to my seat. "And you were with the CIA?" I tease. He laughs.

Snowden is about to say something as we enter the elevator, but at the last moment a woman jumps in so we silently listen to the bossa nova classic "Desafinado" as we ride to an upper floor. When we emerge, he points out a window that overlooks the modern Moscow skyline, glimmering skyscrapers that now overshadow the seven baroque and gothic towers the locals call Stalinskie Vysotki, or "Stalin's high-rises." He has been in Russia for more than a year now. He shops at a local grocery store where no one recognizes him, and he has picked up some of the language. He has learned to live modestly in an expensive city that is cleaner than New York and more sophisticated than Washington. In August, Snowden's temporary asylum is set to expire, but Wizner says they have every reason to expect it will be renewed or extended by Putin's government.

Entering the room he has booked for our interview, he throws his backpack on the bed alongside his baseball cap and a pair of dark sunglasses. He looks thin, almost gaunt, with a narrow face and a faint shadow of a goatee, as if he had just started growing it yesterday. He has on his trademark Burberry eyeglasses, semi-rimless with rectangular lenses. His pale blue shirt seems to be at least a size too big, his wide belt is pulled tight, and he is wearing a pair of black square-toed Calvin Klein loafers. Overall, he has the look of an earnest first-year grad student.

Snowden is careful about what's known in the intelligence world as operational security. As we sit down, he removes the battery from his cell phone. I left my iPhone back at my hotel. Snowden's handlers repeatedly warned me that, even switched off, a cell phone can easily be turned into an NSA microphone. Knowledge of the agency's tricks is one of the ways that Snowden has managed to stay free. Another is by avoiding areas frequented by Americans and other Westerners. Nevertheless, when he's out in public at, say, a computer store, Russians occasionally recognize him. "Shh," Snowden tells them, smiling, putting a finger to his lips.

DESPITE BEING THE subject of a worldwide manhunt, Snowden seems relaxed and upbeat as we drink Cokes and tear away at a giant room-service pepperoni pizza. His 31st birthday is a few days away. Snowden still holds out hope that he will someday be allowed to return to the US. "I told the government I'd volunteer for prison, as long as it served the right purpose," he says. "I care more about the country than what happens to me. But we can't allow the law to become a political weapon or agree to scare people away from standing up for their rights, no matter how good the deal. I'm not going to be part of that."

Meanwhile, Snowden will continue to haunt the US, the unpredictable impact of his actions resonating at home and around

---

Contributor JAMES BAMFORD (washwriter@gmail.com) *is the author of three books on the NSA.*

the world. The documents themselves, however, are out of his control. Snowden no longer has access to them; he says he didn't bring them with him to Russia. Copies are now in the hands of three groups: First Look Media, set up by journalist Glenn Greenwald and American documentary filmmaker Laura Poitras, the two original recipients of the documents; *The Guardian* newspaper, which also received copies before the British government pressured it into transferring physical custody (but not ownership) to *The New York Times*; and Barton Gellman, a writer for *The Washington Post*. It's highly unlikely that the current custodians will ever return the documents to the NSA.

That has left US officials in something like a state of impotent expectation, waiting for the next round of revelations, the next diplomatic upheaval, a fresh dose of humiliation. Snowden tells me it doesn't have to be like this. He says that he actually intended the government to have a good idea about what exactly he stole. Before he made off with the documents, he tried to leave a trail of digital bread crumbs so investigators could determine which documents he copied and took and which he just "touched." That way, he hoped, the agency would see that his motive was whistle-blowing and not spying for a foreign government. It would also give the government time to prepare for leaks in the future, allowing it to change code words, revise operational plans, and take other steps to mitigate damage. But he believes the NSA's audit missed those clues and simply reported the total number of documents he touched—1.7 million. (Snowden says he actually took far fewer.) "I figured they would have a hard time," he says. "I didn't figure they would be completely incapable."

He speculates that the government fears that the documents contain material that's deeply damaging—secrets the custodians have yet to find. "I think they think there's a smoking gun in there that would be the death of them all politically," Snowden says. "The fact that the government's investigation failed—that they don't know what was taken and that they keep throwing out these ridiculous huge numbers—implies to me that somewhere in their damage assessment they must have seen something that was like, 'Holy shit.' And they think it's still out there."

Yet it is very likely that no one knows precisely what is in the mammoth haul of documents—not the NSA, not the custodians, not even Snowden himself. He would not say exactly how he gathered them, but others in the intelligence community have speculated that he simply used a web crawler, a program that can search for and copy all documents containing particular keywords or combinations of keywords. This could account for many of the documents that simply list highly technical and nearly unintelligible signal parameters and other statistics.

And there's another prospect that further complicates matters: Some of the revelations attributed to Snowden may not in fact have come from him but from another leaker spilling secrets under Snowden's name. Snowden himself adamantly refuses to address this possibility on the record. But independent of my visit to Snowden, I was given unrestricted access to his cache of documents in various locations. And going through this archive using a sophisticated digital search tool, I could not find some of the documents that have made their way into public view, leading me to conclude that there must be a second leaker somewhere. I'm not alone in reaching that conclusion. Both Greenwald and security expert Bruce Schneier—who have had extensive access to the cache—have publicly stated that they believe another whistle-blower is releasing secret documents to the media.

In fact, on the first day of my Moscow interview with Snowden, the German newsmagazine *Der Spiegel* comes out with a long story about the NSA's operations in Germany and its cooperation with the German intelligence agency, BND. Among the documents the magazine releases is a top-secret "Memorandum of Agreement" between the NSA and the BND from 2002. "It is not from Snowden's material," the magazine notes.

Some have even raised doubts about whether the infamous revelation that the NSA was tapping German chancellor Angela Merkel's cell phone, long attributed to Snowden, came from his trough. At the time of that revelation, *Der Spiegel* simply attributed the information to Snowden and other unnamed sources. If other leakers exist within the NSA, it would be more than another nightmare for the agency—it would underscore its inability to control its own information and might indicate that Snowden's rogue protest of government overreach has inspired others within the intelligence community. "They still haven't fixed their problems," Snowden says. "They still have negligent auditing, they still have things going for a walk, and they have no idea where they're coming from and they have no idea where they're going. And if that's the case, how can we as the public trust the NSA with all of our information, with all of our private records, the permanent record of our lives?"

The *Der Spiegel* articles were written by, among others, Poitras, the filmmaker who was one of the first journalists Snowden contacted. Her high visibility and expertise in encryption may have attracted other NSA whistle-blowers, and Snowden's cache of documents could have provided the ideal cover. Following my meetings with Snowden, I email Poitras and ask her point-blank whether there are other NSA sources out there. She answers through her attorney: "We are sorry but Laura is not going to answer your question."

"I'm an engineer, not a politician. I'm terrified of giving these talking heads some excuse to jeopardize, smear, and delegitimize A VERY IMPORTANT MOVEMENT."

[redacted]

THE SAME DAY I share pizza with Snowden in a Moscow hotel room, the US House of Representatives moves to put the brakes on the NSA. By a lopsided 293-to-123 tally, members vote to halt the agency's practice of conducting warrantless searches of a vast database that contains millions of Americans' emails and phone calls. "There's no question Americans have become increasingly alarmed with the breadth of unwarranted government surveillance programs used to store and search their private data," the Democratic and Republican sponsors announce in a joint statement. "By adopting this amendment, Congress can take a sure step toward shutting the back door on mass surveillance."

It's one of many proposed reforms that never would have happened had it not been for Snowden. Back in Moscow, Snowden recalls boarding a plane for Hong Kong, on his way to reveal himself as the leaker of a spectacular cache of secrets and wondering whether his risk would be worth it. "I thought it was likely that society collectively would just shrug and move on," he says. Instead, the NSA's surveillance has become one of the most

pressing issues in the national conversation. President Obama has personally addressed the issue, Congress has taken up the issue, and the Supreme Court has hinted that it may take up the issue of warrantless wiretapping. Public opinion has also shifted in favor of curtailing mass surveillance. "It depends a lot on the polling question," he says, "but if you ask simply about things like my decision to reveal Prism"—the program that allows government agencies to extract user data from companies like Google, Microsoft, and Yahoo—"55 percent of Americans agree. Which is extraordinary given the fact that for a year the government has been saying I'm some kind of supervillain."

That may be an overstatement, but not by much. Nearly a year after Snowden's first leaks broke, NSA director Keith Alexander claimed that Snowden was "now being manipulated by Russian intelligence" and accused him of causing "irreversible and significant damage." More recently, Secretary of State John Kerry said that "Edward Snowden is a coward, he is a traitor, and he has betrayed his country." But in June, the government seemed to be backing away from its most apocalyptic rhetoric. In an interview with *The New York Times*, the new head of the NSA, Michael Rogers, said he was "trying to be very specific and very measured in my characterizations": "You have not heard me as the director say, 'Oh my God, the sky is falling.'"

Go to **WIRED.COM** for extra photos and videos and to hear Edward Snowden in his own words.

"Not only do I believe in something, I believe in it enough that I'm willing to set my own life on fire and BURN IT TO THE GROUND."

Snowden keeps close tabs on his evolving public profile, but he has been resistant to talking about himself. In part, this is because of his natural shyness and his reluctance about "dragging family into it and getting a biography." He says he worries that sharing personal details will make him look narcissistic and arrogant. But mostly he's concerned that he may inadvertently detract from the cause he has risked his life to promote. "I'm an engineer, not a politician," he says. "I don't want the stage. I'm terrified of giving these talking heads some distraction, some excuse to jeopardize, smear, and delegitimize a very important movement."

But when Snowden finally agrees to discuss his personal life, the portrait that emerges is not one of a wild-eyed firebrand but of a solemn, sincere idealist who—step by step over a period of years—grew disillusioned with his country and government.

Born on June 21, 1983, Snowden grew up in the Maryland suburbs, not far from the NSA's headquarters. His father, Lon, rose through the enlisted ranks of the Coast Guard to warrant officer, a difficult path. His mother, Wendy, worked for the US District Court in Baltimore, while his older sister, Jessica, became a lawyer at the Federal Judicial Center in Washington. "Everybody in my family has worked for the federal government in one way or another," Snowden says. "I expected to pursue the same path." His father told me, "We always considered Ed the smartest one in the family." It didn't surprise him when his son scored above 145 on two separate IQ tests.

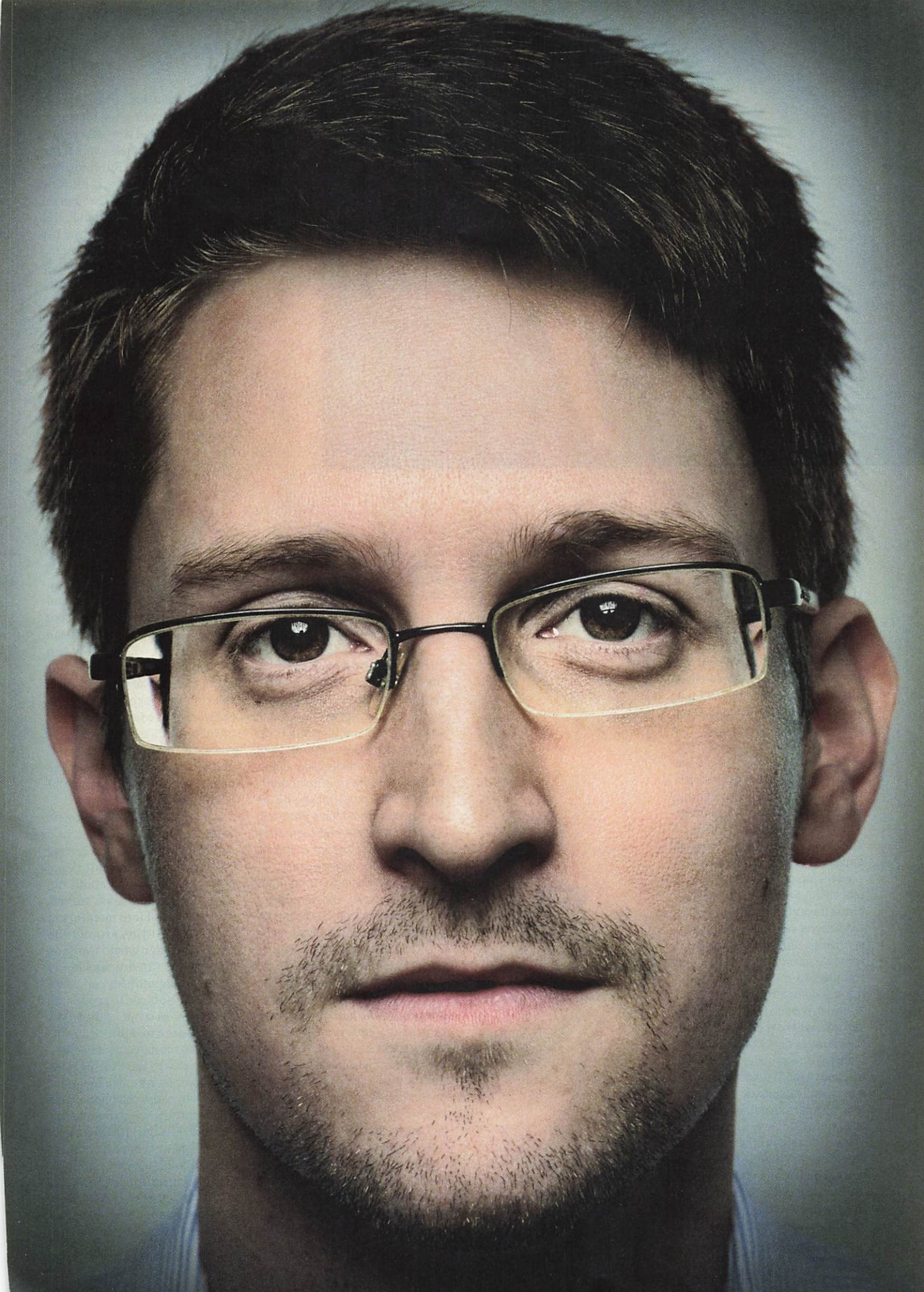
Rather than spending hours watching television or playing sports as a kid, Snowden fell in love with books, especially Greek mythology. "I remember just going into those books, and I would disappear with them for hours," he says. Snowden says reading about myths played an important role growing up, providing him with a framework for confronting challenges, including moral dilemmas. "I think that's when I started thinking about how we identify problems, and that the measure of an individual is how they address and confront those problems," he says.

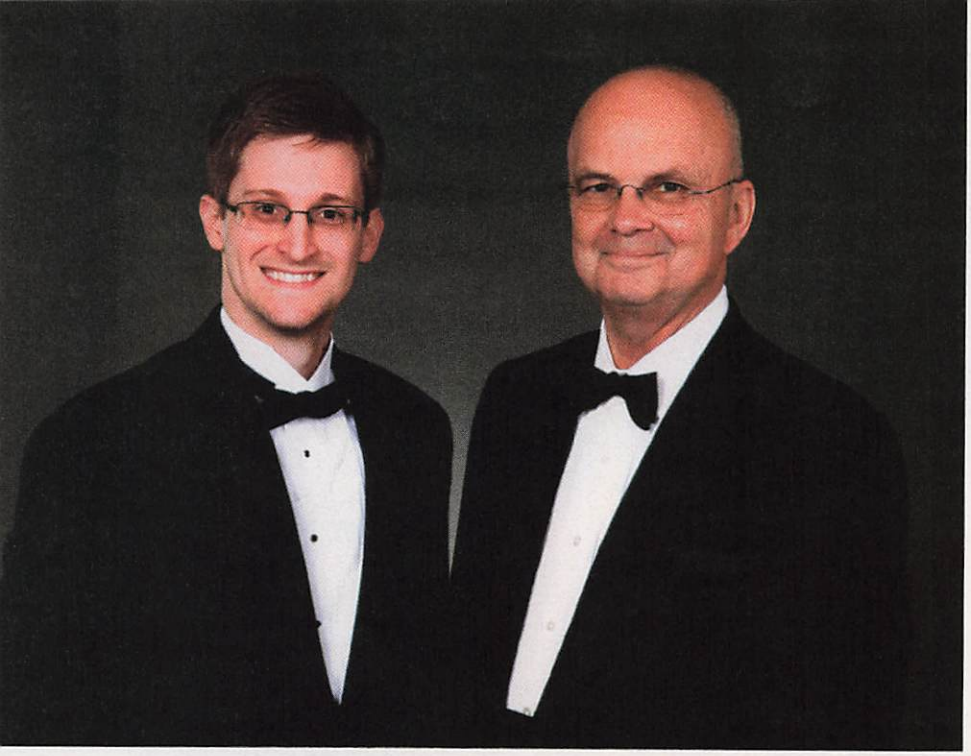
Soon after Snowden revealed himself as a leaker, there was enormous media focus on the fact that he quit school after the 10th grade, with the implication that he was simply an uneducated slacker. But rather than delinquency, it was a bout of mononucleosis that caused him to miss school for almost nine months. Instead of falling back a grade, Snowden enrolled in community college. He'd loved computers since he was a child, but now that passion deepened. He started working for a classmate who ran his own tech business. Coincidentally, the company was run from a house at Fort Meade, where the NSA's headquarters are located.

Snowden was on his way to the office when the 9/11 attacks took place. "I was driving in to work and I heard the first plane hit on the radio," he says. Like a lot of civic-minded Americans, Snowden was profoundly affected by the attacks. In the spring of 2004, as the ground war in Iraq was heating up with the first battle of Fallujah, he volunteered for the Army special forces. "I was very open to the government's explanation—almost propaganda—when it came to things like Iraq, aluminum tubes, and vials of anthrax," he says. "I still very strongly believed that the government wouldn't lie to us, that our government had noble intent, and that the war in Iraq was going to be what they said it was, which was a limited, targeted effort to free the oppressed. I wanted to do my part."

Snowden says that he was particularly attracted to the special forces because it offered the chance to learn languages. After performing well on an aptitude test, he was admitted. But the physical requirements were more challenging. He broke both of his legs in a training accident. A few months later he was discharged.

Out of the Army, Snowden landed a job as a security guard at a top-secret facility that required him to get a high-level security clearance. He passed a polygraph exam and the stringent background check and, almost without realizing it, he found himself on his way to a career in the clandestine world of intelligence. After attending a job fair focused on intelligence agencies, he was offered a position at the CIA, where he was





Snowden with General Michael Hayden at a gala in 2011. Hayden, former director of the NSA and CIA, defended US surveillance policies in the wake of Snowden's revelations.

assigned to the global communications division, the organization that deals with computer issues, at the agency's headquarters in Langley, Virginia. It was an extension of the network and engineering work he'd been doing since he was 16. "All of the covert sites—cover sites and so forth—they all network into the CIA headquarters," he says. "It was me and one other guy who worked the late shifts." But Snowden quickly discovered one of the CIA's biggest secrets: Despite its image as a bleeding-edge organization, its technology was woefully out-of-date. The agency was not at all what it appeared to be from the outside.

As the junior man on the top computer team, Snowden distinguished himself enough to be sent to the CIA's secret school for technology specialists. He lived there, in a hotel, for some six months, studying and training full-time. After the training was complete, in March 2007, Snowden headed for Geneva, Switzerland, where the CIA was seeking information about the banking industry. He was assigned to the US Mission to the United Nations. He was given a diplomatic passport, a four-bedroom apartment near the lake, and a nice cover assignment.

It was in Geneva that Snowden would see firsthand some of the moral compromises CIA agents made in the field. Because spies were promoted based on the number of human sources they recruited, they tripped over each other trying to sign up anyone they could, regardless of their value. Operatives would get targets drunk enough to land in jail and then bail them out—putting the target in their debt. "They do really risky things to recruit them that have really negative, profound impacts on the person and would have profound impacts on our national reputation if we got caught," he says. "But we do it simply because we can."

Go to **WIRED.COM** for behind-the-scenes video featuring interviews with author James Bamford and photographer Platon.

While in Geneva, Snowden says, he met many spies who were deeply opposed to the war in Iraq and US policies in the Middle East. "The CIA case officers were all going, what the hell are we doing?" Because of his job maintaining computer systems and network operations, he had more access than ever to information about the conduct of the war. What he learned troubled him deeply. "This was the Bush period, when the war on terror had gotten really dark," he says. "We were torturing people; we had warrantless wiretapping."

He began to consider becoming a whistle-blower, but with Obama about to be elected, he held off. "I think even Obama's critics were impressed and optimistic about the values that he represented," he says. "He said that we're not going to sacrifice our rights. We're not going to change who we are just to catch some small percentage more terrorists." But Snowden grew disappointed as, in his view, Obama didn't follow through on his lofty rhetoric. "Not only did they not fulfill those promises, but they entirely repudiated them," he says. "They went in the other direction. What does that mean for a society, for a democracy, when the people that you elect on the basis of promises can basically suborn the will of the electorate?"

It took a couple of years for this new level of disillusionment to set in. By that time—2010—Snowden had shifted from the CIA to the NSA, accepting a job as a technical expert in Japan with Dell, a major contractor for the agency. Since 9/11 and the enormous influx of intelligence money, much of the NSA's work had been outsourced to defense contractors, including Dell and Booz Allen Hamilton. For Snowden, the Japan posting was especially attractive: He had wanted to visit the country since he was a teen. Snowden worked at the NSA offices at Yokota Air Base, outside Tokyo, where he instructed top officials and military officers on how to defend their networks from Chinese hackers.

But Snowden's disenchantment would only grow. It was bad enough when spies were getting bankers drunk to recruit them; now he was learning about targeted killings and mass surveillance, all piped into monitors at the NSA facilities around the world. Snowden would watch as military and CIA drones silently turned people into body parts. And he would also begin to appreciate the enormous scope of the NSA's surveillance capabilities, an ability to map the movement of everyone in a city by monitoring their MAC address, a unique identifier emitted by every cell phone, computer, and other electronic device.

Even as his faith in the mission of US intelligence services continued to crumble, his upward climb as a trusted technical expert proceeded. In 2011 he returned to Maryland, where he spent about a year as Dell's lead technologist working

with the CIA's account. "I would sit down with the CIO of the CIA, the CTO of the CIA, the chiefs of all the technical branches," he says. "They would tell me their hardest technology problems, and it was my job to come up with a way to fix them."

But in March 2012, Snowden moved again for Dell, this time to a massive bunker in Hawaii where he became the lead technologist for the information-sharing office, focusing on technical issues. Inside the "tunnel," a dank, chilly, 250,000-square-foot pit that was once a torpedo storage facility, Snowden's concerns over the NSA's capabilities and lack of oversight grew with each passing day. Among the discoveries that most shocked him was learning that the agency was regularly passing raw private communications—content as well as metadata—to Israeli intelligence. Usually information like this would be "minimized," a process where names and personally identifiable data are removed. But in this case, the NSA did virtually nothing to protect even the communications of people in the US. This included the emails and phone calls of millions of Arab and Palestinian Americans whose relatives in Israel-occupied Palestine could become targets based on the communications. "I think that's amazing," Snowden says. "It's one of the biggest abuses we've seen." (The operation was reported last year by *The Guardian*, which cited the Snowden documents as its source.)

Another troubling discovery was a document from NSA director Keith Alexander that showed the NSA was spying on the pornography-viewing habits of political radicals. The memo suggested that the agency could use these "personal vulnerabilities" to destroy the reputations of government critics who were not in fact accused of plotting terrorism. The document then went on to list six people as future potential targets. (Greenwald published a redacted version of the document last year on the Huffington Post.)

Snowden was astonished by the memo. "It's much like how the FBI tried to use Martin Luther King's infidelity to talk him into killing himself," he says. "We said those kinds of things were inappropriate back in the '60s. Why are we doing that now? Why are we getting involved in this again?"

In the mid-1970s, Senator Frank Church, similarly shocked by decades of illegal spying by the US intelligence services, first exposed the agencies' operations to the public. That opened the door to long-overdue reforms, such as the Foreign Intelligence Surveillance Act. Snowden sees parallels between then and now. "Frank Church analogized it as being on the brink of the abyss," he says. "He was concerned that once we went in we would never come out. And the concern we have today is that we're on the brink of that abyss again." He realized, just like Church had before him, that the only way to cure the abuses of the government was to expose them. But Snowden didn't have a Senate committee at his disposal or the power of congressional subpoena. He'd have to carry out his mission covertly, just as he'd been trained.

THE SUN SETS LATE here in June, and outside the hotel window long shadows are beginning to envelop the city. But Snowden doesn't seem to mind that the interview is stretching into the evening hours. He is living on New York time, the better to communicate with his stateside supporters and stay on top of the American news cycle. Often, that means hearing in almost real time the harsh assessments of his critics. Indeed, it's not only government apparatchiks that take issue with what Snowden did next—moving from disaffected operative to whistle-blowing dissident. Even in the technology industry, where he has many supporters, some accuse him of playing too fast and loose with dangerous information. Netscape founder and prominent venture capitalist Marc Andreessen has told CNBC, "If you looked up in the encyclopedia 'traitor,' there's a picture of Edward Snowden." Bill Gates delivered a similarly cutting assessment in a *Rolling Stone* interview. "I think he broke the law, so I certainly wouldn't characterize him as a hero," he said. "You won't find much admiration from me."

Snowden adjusts his glasses; one of the nose pads is missing, making them slip occasionally. He seems lost in thought, looking back to the moment of decision, the point of no return. The time when, thumb drive in hand, aware of the enormous potential consequences, he secretly went to work. "If the government will not represent our interests," he says, his face serious, his words slow, "then the public will champion its own interests. And whistle-blowing provides a traditional means to do so."

The NSA had apparently never predicted that someone like Snowden might go rogue. In any case, Snowden says he had no problem accessing, downloading, and extracting all the confidential information he liked. Except for the very highest level of classified documents, details about virtually all of the NSA's surveillance programs were accessible to anyone, employee or contractor, private or general, who had top-secret NSA clearance and access to an NSA computer.

But Snowden's access while in Hawaii went well beyond even this. "I was the top technologist for the information-sharing office in Hawaii," he says. "I had access to everything."

Well, almost everything. There was one key area that remained out of his reach: the NSA's aggressive cyberwarfare activity around the world. To get access to that last cache of secrets, Snowden landed a job as an infrastructure analyst with another giant NSA contractor, Booz Allen. The role gave him rare dual-hat authority covering both domestic and foreign intercept capabilities—allowing him to trace domestic cyberattacks back to their country of origin. In his new job, Snowden became immersed in the highly secret world of planting malware into systems around the world and stealing gigabytes of foreign secrets. At the same time, he was also able to confirm, he says, that vast amounts of US communications "were being intercepted and stored without a warrant, without any requirement for criminal suspicion, probable cause, or individual designation." He gathered that evidence and secreted it safely away.

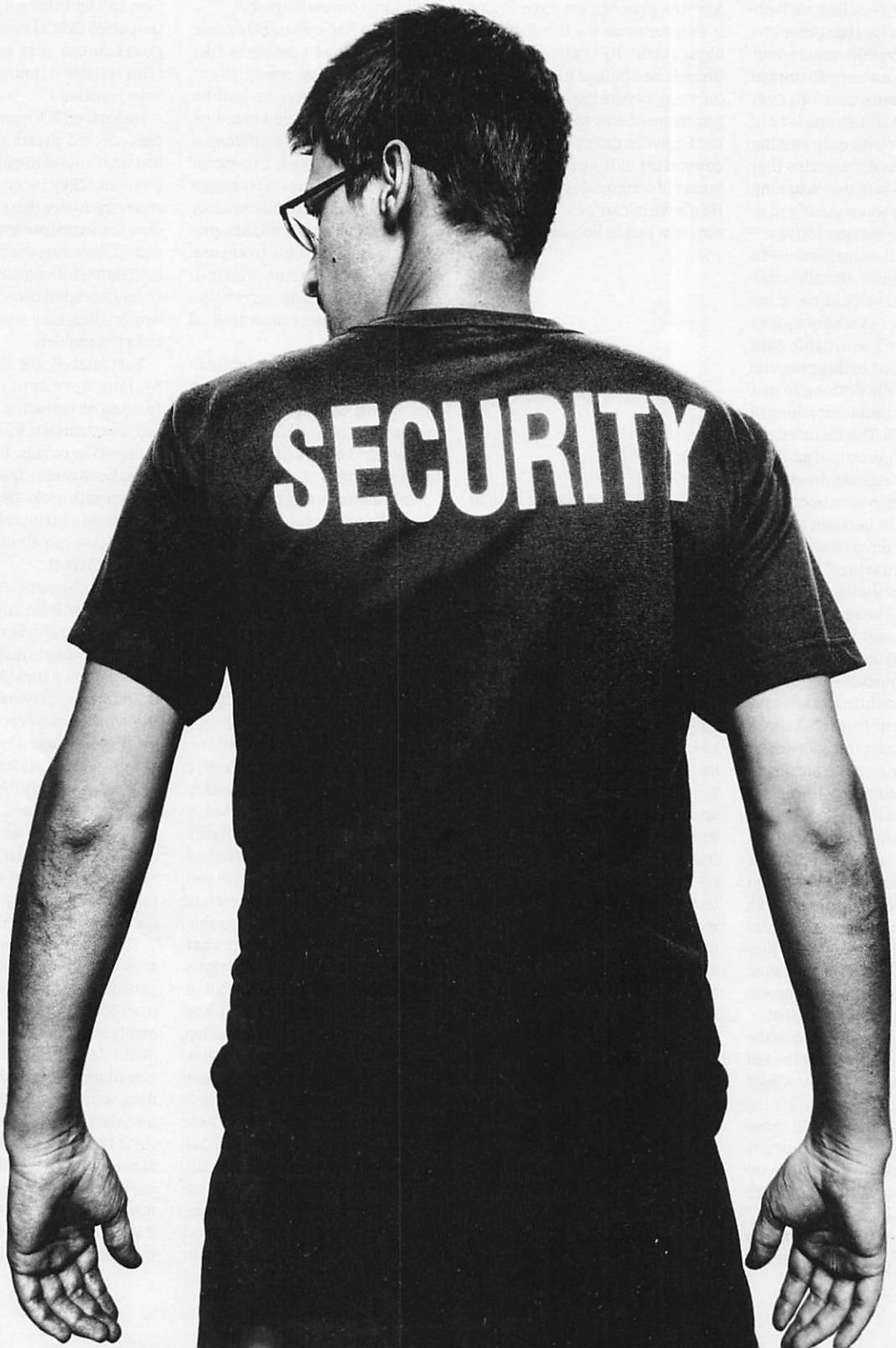
By the time he went to work for Booz Allen in the spring of 2013, Snowden was thoroughly disillusioned, yet he had not lost his capacity for shock. One day an intelligence officer told him that TAO—a division of NSA hackers—had attempted in 2012 to remotely install an exploit in one of the core routers at a major Internet service provider in Syria, which was in the midst of a prolonged civil war. This would have given the NSA access to email and other Internet traffic from much of the country. But something went wrong, and the router was bricked instead—rendered totally inoperable. The failure of this router caused Syria to suddenly lose all connection to the Internet—although the public didn't know that the US government was responsible. (This is the first time the claim has been revealed.)

Inside the TAO operations center, the panicked government hackers had what Snowden calls an "oh shit" moment. They raced to remotely repair the router, desperate to cover their tracks and prevent the Syrians from discovering the sophisticated infiltration software used to access the network. But because the router was bricked, they were powerless to fix the problem.

Fortunately for the NSA, the Syrians were apparently more focused on restoring the nation's Internet than on tracking down the cause of the outage. Back at TAO's operations center, the tension was broken with a joke that contained more than a little truth: "If we get caught, we can always point the finger at Israel."

Much of Snowden's focus while working for Booz Allen was analyzing potential cyberattacks from China. His targets included institutions normally considered outside the military's purview. He thought the work was overstepping the intelligence agency's mandate. "It's no secret that we hack China very aggressively," he says. "But we've crossed lines. We're hacking universities and hospitals and wholly civilian infrastructure rather than actual government targets and military targets. And that's a real concern."

The last straw for Snowden was a secret program he discovered while getting up to speed on the capabilities of the NSA's enormous and highly secret data storage facility in Bluffdale, Utah. Potentially capable of holding upwards of a yottabyte of data, some 500 quintillion pages of text, the 1 million-square-foot building is known within the NSA as the Mission Data Repository. (According to Snowden, the original name was Massive Data Repository, but it was changed after some staffers thought it sounded too creepy—and


SECURITY

accurate.) Billions of phone calls, faxes, emails, computer-to-computer data transfers, and text messages from around the world flow through the MDR every hour. Some flow right through, some are kept briefly, and some are held forever.

The massive surveillance effort was bad enough, but Snowden was even more disturbed to discover a new, Strangelovian cyberwarfare program in the works, codenamed MonsterMind. The program, disclosed here for the first time, would automate the process of hunting for the beginnings of a foreign cyberattack. Software would constantly be on the lookout for metadata containing algorithms known or suspected to be malware. When it detected a suspect algorithm, MonsterMind would automatically block it from entering the country—a "kill" in cyber terminology.

Programs like this had existed for decades, but MonsterMind software would add a unique new capability: Instead of simply detecting and killing the malware at the point of entry, MonsterMind would automatically fire back, with no human involvement. That's a problem, Snowden says, because the initial attacks are often routed through computers in innocent third countries. "These attacks can be spoofed," he says. "You could have someone sitting in China, for example, making it appear that one of these attacks is originating in Russia. And then we end up shooting back at a Russian hospital. What happens next?"

In addition to the possibility of accidentally starting a war, Snowden views MonsterMind as the ultimate threat to privacy because, in order for the system to work, the NSA first would have to secretly get access to virtually all private communications coming in from overseas to people in the US. "The argument is that the only way we can identify these malicious traffic flows and respond to them is if we're analyzing all traffic flows," he says. "And if we're analyzing all traffic flows, that means we have to be intercepting all traffic flows. That means violating the Fourth Amendment, seizing private communications without a warrant, without probable cause or even a suspicion of wrongdoing. For everyone, all the time." (A spokesperson for the NSA declined to comment on MonsterMind, the malware in Syria, or any other aspect of this article.)

Given the NSA's new data storage mausoleum in Bluffdale, its potential to start an accidental war, and the charge to conduct surveillance on all incoming communications, Snowden believed he had no choice but to take his thumb drives and tell the world what he knew. The only question was when.

On March 13, 2013, sitting at his desk in the "tunnel" surrounded by computer screens, Snowden read a news story that convinced him that the time had come to act. It was an account of director of national intelligence James Clapper telling a Senate committee that the NSA does "not wittingly" collect information on millions of Americans. "I think I was reading it in the paper the next day, talking to coworkers, saying, can you believe this shit?"

Snowden and his colleagues had discussed the routine deception around the breadth of the NSA's spying many times, so it wasn't surprising to him when they had little reaction to Clapper's testimony. "It was more of just acceptance," he says, calling it "the banality of evil"—a reference to Hannah Arendt's study of bureaucrats in Nazi Germany.

"It's like the boiling frog," Snowden tells me. "You get exposed to a little bit of evil, a little bit of rule-breaking, a little bit of dishonesty, a little bit of deceptiveness, a little bit of disservice to the public interest, and you can brush it off, you can come to justify it. But if you do that, it creates a slippery slope that just increases over time, and by the time you've been in 15 years, 20 years, 25 years, you've seen it all and it doesn't shock you. And so you see it as normal. And that's the problem, that's what the Clapper event was all about. He saw deceiving the American people as what he does, as his job, as something completely ordinary. And he was right that he wouldn't be punished for it, because he was revealed as having lied under oath and he didn't even get a slap on the wrist for it. It says a lot about the system and a lot about our leaders." Snowden decided it was time to hop out of the water before he too was boiled alive.

At the same time, he knew there would be dire consequences. "It's really hard to take that step—not only do I believe in something, I believe in it enough that I'm willing to set my own life on fire and burn it to the ground."

But he felt that he had no choice. Two months later he boarded a flight to Hong Kong with a pocket full of thumb drives.

THE AFTERNOON OF our third meeting, about two weeks after our first, Snowden comes to my hotel room. I have changed locations and am now staying at the Hotel National, across the street from the Kremlin and Red Square. An icon like the Metropol, much of Russia's history passed through its front doors at one time or another. Lenin once lived in Room 107, and the ghost of Felix Dzerzhinsky, the feared chief of the old Soviet secret police who also lived here, still haunts the hallways.

But rather than the Russian secret police, it's his old employers, the CIA and the NSA, that Snowden most fears. "If somebody's really watching me, they've got a team of guys whose job is just to hack me," he says. "I don't think they've geolocated me, but they almost certainly monitor who I'm talking to online. Even if they don't know what you're saying, because it's encrypted, they can still get a lot from who you're talking to and when you're talking to them."

More than anything, Snowden fears a blunder that will destroy all the progress toward reforms for which he has sacrificed so much. "I'm not self-destructive. I don't want to self-immolate and erase myself from the pages of history. But if we don't take chances, we can't win," he says. And so he takes great pains to stay one step ahead of his presumed pursuers—he switches computers and email accounts constantly. Nevertheless, he knows he's liable to be compromised eventually: "I'm going to slip up and they're going to hack me. It's going to happen."

Indeed, some of his fellow travelers have already committed some egregious mistakes. Last year, Greenwald found himself unable to open the encryption on a large trove of secrets from GCHQ—the British counterpart of the NSA—that Snowden had passed to him. So he sent his longtime partner, David Miranda, from their home in Rio to Berlin to get another set from Poitras. But in making the arrangements, *The Guardian* booked a transfer through London. Tipped off, probably as a result of GCHQ surveillance, British authorities detained Miranda as soon as he arrived and questioned him for nine hours. In addition, an external hard drive containing 60 gigabits of data—about 58,000 pages of documents—was seized. Although the documents had been encrypted using a sophisticated program known as True Crypt, the British authorities discovered a paper of Miranda's with the password for one of the files, and they were able to decrypt about 75 pages. (Greenwald has still not gained access to the complete GCHQ documents.)

Another concern for Snowden is what he calls NSA fatigue—the public becoming numb to disclosures of mass surveillance, just as it becomes inured to news of battle deaths during a war. "One death is a tragedy, and a million is a statistic," he says, mordantly quoting Stalin. "Just as the violation of Angela Merkel's rights is a massive scandal and the violation of 80 million Germans is a nonstory."

Nor is he optimistic that the next election will bring any meaningful reform. In the end, Snowden thinks we should put our faith in technology—not politicians. "We have the means and we have the technology to end mass surveillance without any legislative action at all, without any policy changes." The answer, he says, is robust encryption. "By basically adopting changes like making encryption a universal standard—where all communications are encrypted by default—we can end mass surveillance not just in the United States but around the world."

Until then, Snowden says, the revelations will keep coming. "We haven't seen the end," he says. Indeed, a couple of weeks after our meeting, *The Washington Post* reported that the NSA's surveillance program had captured much more data on innocent Americans than on its intended foreign targets. There are still hundreds of thousands of pages of secret documents out there—to say nothing of the other whistle-blowers he may have already inspired. But Snowden says that information contained in any future leaks is almost beside the point. "The question for us is not what new story will come out next. The question is, what are we going to do about it?" ■

How to save the net

096

THE SNOWDEN REVELATIONS WERE JUST THE BEGINNING. THE INTERNET IS FACING AN ARRAY OF THREATS, ANY ONE OF WHICH COULD END THE NET AS WE KNOW IT. SIX EXPERTS EXPLAIN WHAT COULD GO WRONG—AND HOW TO BRING US BACK FROM THE BRINK.

Break Up the NSA

BRUCE SCHNEIER
Security consultant and CTO, Co3 Systems

By treating the Internet as a giant surveillance platform, the NSA has betrayed the Internet and the world. It has subverted the products, protocols, and standards that we use to protect ourselves. It has left us all vulnerable—to foreign governments, to cybercriminals, to hackers. And it has transformed the Internet into a medium that no one can trust.

The world has changed dramatically since the NSA was founded 62 years ago. Back then, it was easy to spy on foreign governments while shielding our own from snoops. Today, the NSA's intelligence mission has expanded from just government-on-government espionage to government-on-population surveillance. At the same time, the communications world has shifted from dedicated circuits that can be passively tapped to a single global Internet infrastructure that requires active attack to eavesdrop on. Everyone uses the same networks, and creating the capability to eavesdrop on foreign communications by engineering backdoors into US technology leaves domestic transmissions vulnerable to eavesdropping. The NSA's aggressive data-gathering, with seemingly little regard for how that might compromise the security of everyday digital communications—and with only loose oversight (at best) by government watchdogs—has far exceeded what any modern and free society should reasonably expect. Breaking up the agency would do a lot to bring it under control.

The way I see it, the problem is that the NSA has too many missions: a military mission dedicated to network attacks and political espionage, a law enforcement mission focused on individual bad actors across the globe, and a defensive mission devoted to protecting the nation's information infrastructure.

Take the NSA's military mission. Spying on foreign governments properly belongs within the Department of Defense under US Cyber Command. These days, espionage requires offensive actions in cyberspace—for example, breaking into networks and installing malware. These NSA programs should be treated with the same sensitivity as any other military operation. Attacking a foreign computer network is potentially an act of war, and we should be very careful in choosing to do so.

But the NSA's extensive domestic and foreign surveillance of individuals is an activity that is properly placed inside the Justice Department. There it can be subject to standard domestic law: the Constitution, the warrant process, conventional courts, and much less secrecy. These are mechanisms we have long used to protect ourselves while giving the police, for example, extraordinary powers of investigation.

Finally, the NSA's defensive mission—protecting US communications from eavesdropping and other attacks—should be transferred to a new organization. This function hasn't been talked about much since the Snowden revelations began in June 2013, but it's a vital one, and the NSA is good at it. It has expertise in cryptography, software security, and network security—everything we need to make ourselves safer on the Internet. This new agency would not have to be secret at all, because its ultimate goal ought to be a more secure Internet for everyone.

When I present this proposal to military-minded people, the most common reaction is to say it would be inefficient. There would be duplication of effort and redundancy of expertise. That's true. My counterargument is that efficiency is not the most important goal here; security and liberty are. Deliberately making the police less efficient is how we currently protect ourselves from overreaching police power. Similarly, separating the current functions of the NSA along legal lines rather than technical capabilities is how we can protect ourselves from an overly aggressive agency.

Breaking up the NSA would ensure that security trumps surveillance, and openness trumps secrecy. It's how we regain the trust we've lost.

Don't Give In to Big ISPs

REED HASTINGS
CEO, Netflix

The Internet has already changed how we live and work, and we're only just getting started. Who'd have thought even five years ago that people would be streaming Ultra HD 4K video over their home Internet connections?

Technological advances are driving this evolution and will continue to do so only if we make sure the companies controlling consumers' access to the Internet don't adopt business practices that stifle its revolutionary nature. The next Netflix won't stand a chance if the largest US Internet service providers are allowed to merge or demand extra fees from content companies trying to reach their subscribers.

This year we reluctantly agreed to pay AT&T, Comcast, and Verizon for access to our mutual subscribers, who were seeing a rapid decline in their Netflix viewing experience because of congestion at the connection point where we transfer content to the ISP. The ISPs argue that our data-rich ser-

vices take up limited capacity on their networks. But broadband is not a finite resource. Network limitations are largely the result of business decisions to not keep pace with subscriber demand in a world where the Internet increasingly is the main vehicle for all kinds of entertainment, from gaming to movies to video chats with loved ones.

Consider this: A single fiber-optic strand the diameter of a human hair can carry 101.7 terabits of data per second, enough to support nearly every Netflix subscriber watching content in HD at the same time. And while technology has improved and capacity has increased, costs have continued to decline. A few more shelves of equipment might be needed in the buildings that house interconnection points, but broadband itself is as limitless as its uses.

We'll never realize broadband's potential if large ISPs erect a pay-to-play system that charges both the sender and receiver for the same content. That's why we at Netflix are so vocal about the need for strong net neutrality, which for us means ISPs should enable equal access to content without favoring, impeding, or charging particular content providers. Those practices would stunt innovation and competition and hold back the broader development of the Internet and the economic benefits it brings.

Customers pay companies like AT&T, Comcast, and Verizon a monthly fee, and some are even financially penalized if they exceed usage caps. Charging us a separate fee ultimately means consumers pay twice—first for their broadband connection and second through higher-cost or lower-quality Internet services.

It's worth noting that Netflix connects directly with hundreds of ISPs globally, and 99 percent of those agreements don't involve access fees. It is only a handful of the largest US ISPs, which control the majority of consumer connections, demanding this toll. Why would more profitable, larger companies charge for connections and capacity that smaller companies provide for free? Because they can.

This is the reason we have opposed Comcast's proposed acquisition of Time Warner Cable. Comcast has already shown the ability to use its market position to require access fees, as evidenced by the Netflix congestion that cleared up as soon as we reached an agreement with them. A combined company that controls over half of US residential Internet connections would have even greater incentive to wield this power.

The Federal Communications Commission has historically focused only on last-mile connections—the final leg of the Internet that connects individual homes to the World Wide Web. Today's problem spots are further upstream, at the choke point where companies like Netflix pass our traffic off to the ISPs. If the FCC doesn't expand its purview to include these transactions, it would be better to have no rules than the ones being proposed—which simply legalize discrimination on the Internet.

The next Netflix won't stand a chance if the largest Internet service providers in the US are allowed to merge.

A CDC for Cybercrime

PETER W. SINGER
Strategist, New America Foundation

The Internet may be made up of software and hardware, but it is an ecosystem that depends on a key human value: trust. The networks and systems must be able to trust the information we are sending, and in turn we have to be able to trust the information we receive.

This system of trust has allowed businesses around the world to share data rapidly and reliably on almost every issue—except their own security. Too many are still unwilling to share crucial information about the network attacks, data breaches, and outright cybertheft they've experienced—and what they do to defend themselves. Companies keep everything from basic facts to crucial technical details from one another and, notably, from the government, largely because they're suspicious and fearful about what others might do with that information. The fears run the gamut: Tech companies worry about their brand, potential prosecution, even exploitation by the intelligence community; consumer firms wonder how the stock market will react; oil companies fear aiding their competitors; and power companies are nervous that information will end up being exploited by those they fear most of all: environmental lawyers.

The result is that, as cybersecurity guru Kevin Mandia of FireEye puts it, "nobody gets smarter." Victims of attacks may learn how to adjust to a new threat, but only after the fact, while the world at large too often doesn't get the guidance needed to bolster defenses in a timely manner.

Discussions of what government can do about this predicament tend to focus on some kind of change in the law to raise regulations and/or lower liabilities. That is well and good, but government should also think about building a new organization for the cyber age by taking inspiration from one of the most successful agencies created in the past.

The Centers for Disease Control and Prevention started out in 1946 with a mission to prevent malaria in the US and went on to help eliminate global killers like smallpox. The CDC succeeded because it established itself as a hub for research on threats the private market wasn't equipped or motivated to confront and the public system wasn't well organized to handle. In so doing, it became a trusted clearinghouse for public and private actors in the health system by sharing important but anonymized information with anyone who needed it. Though its leadership is appointed by the government, its staff is recruited from a wide range of specialties to enhance its independence and credibility.

A similar gap could be filled by creating a cyber-CDC. By having a research focus and origin, it would distinguish itself from organizations like the NSA, law enforcement agencies, the federal Computer Emergency Readiness Team, trade groups, and private companies that now try to play this intermediary role. These groups each bring strong capabilities, but they also often have mixed interests and dueling motives that can undermine trust. What's more, this new agency would have a more cohesive structure, mandate, and funding than the valiant but outgunned volunteer outfits that also play in this space.

The benefits would extend up to the geopolitical sphere (the CDC proved to be a trusted diplomatic back channel during the Cold War) and down to the individual level. Just as the CDC plays a key part in public education on preventative health care, so too could a cyber-CDC be a hub for better "cyber-hygiene." When the Heartbleed security bug was discovered in April—creating potential web vulnerabilities on a mass scale—everyone from software companies and media outlets to the NSA was asked for answers, but none of their responses were fully trusted.

There are many technical, policy, and legal gaps in cybersecurity today. But maybe what is missing most is an intermediary we can trust. This new problem might be best answered by an old success story.

The premise of openness—that information and data should be freely exchangeable—is at risk.

Keep the Net Open

VINTON G. CERF
Vice president and chief Internet evangelist, Google

For all of its history, the Internet has enjoyed the fruits of an *openness* principle: the idea that anyone can reach any site online and that information and data should be freely exchangeable. Applications such as YouTube and Skype have been introduced without the need to seek permission of any Internet service provider or government. Nearly 3 billion users enjoy myriad mobile apps and other Internet-based services thanks to the open standards, common interfaces, and rich connectivity that permissionless innovation has delivered.

Today, that premise of openness is at risk—because it threatens the very concept of sovereign national borders that was established in 1648 by the Treaty of Westphalia. In response, more governments are prohibiting access to certain kinds of content, leading to national and regional legislation that may splinter the Internet and interfere with end-to-end connectivity. The Snowden assertions have led countries like Germany and Brazil to propose that all information about their citizens must be confined to physical equipment within their borders. Others, like Iran, want to build isolated "national internets." China already monitors and controls what information is accessible to its citizens.

Another risk factor for the Internet is the potential for international political and trade disputes to affect connectivity and freedom of speech. For example, new top-level domain names like .vin and .wine have led to major complaints by France, Spain, and Portugal over who may properly register second-level domain names such as champagne. If Internet governance policy gets mixed up with trade policy, one might see attempts to exchange Internet openness for some adjustment in a tariff barrier or other political accommodation. Such disputes come and go, but if they produce uncertainty about connectivity, they could erode motivation for investing in Internet businesses and infrastructure.

We have a unique opportunity to redesign the Internet's governance by enshrining the openness principle and the concept that all stakeholders should participate in policy development. The US has offered to transfer its present oversight responsibilities to a private-sector, nonprofit, multi-stakeholder organization, the Internet Corporation for Assigned Names and Numbers, which was originally established in 1998 for precisely this purpose. I strongly support this proposal. There is no guarantee that such an approach will be accepted by other nations, but the value of an open, fully connected, and accessible Internet should not and must not be underestimated. Societies of the 21st century everywhere on the planet deserve nothing less.

Build a Backup

DANNY HILLIS
Cofounder, Applied Minds

You may have had the bad luck of being stuck on a runway when a router failure in Utah grounded commercial flights around the country for several hours. Or maybe you were frustrated by not being able to access government websites the day the .gov domain administration had a glitch in its system. These minor mishaps over the past decade are early rumblings of an uncomfortable truth: The Internet is more fragile than it appears.

The problems with the .gov websites and the FAA were caused by accidents, but such accidents can have widespread effects. In 2008, censorship efforts by the government of Pakistan unintentionally caused YouTube to become inaccessible throughout the world. In another incident in 2010, much of the Internet was rerouted through China for a few hours, including traffic between US military sites. China Telecom plausibly claimed this was also an accident, but scenarios like this could be easily arranged.

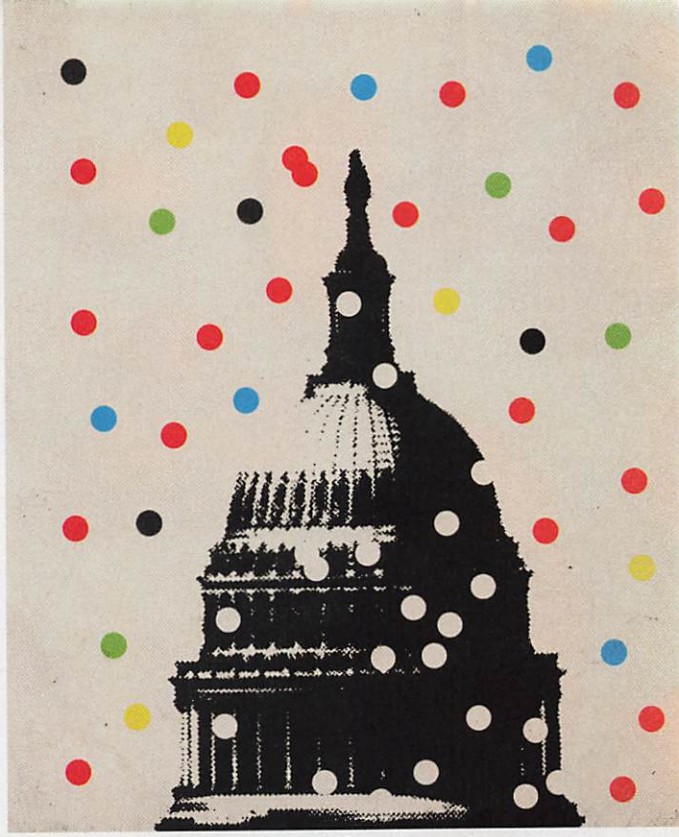
The vulnerability of the Internet would be just an annoyance if it affected only YouTube and email, but it is becoming increasingly fundamental to our financial system, our national security, and other vital services. Already, many food and fuel supplies are dispatched through the Internet. Even the telephone and electrical systems are becoming Internet-dependent, and thus more vulnerable to accidental breakdowns and deliberate attacks.

The Internet was designed decades ago to connect a set of friendly collaborators, most in academic research. At that time, no one envisioned that it would become a critical part of our infrastructure. Decisions were made then that make it impossible to retrofit the Internet with the kind of safety and dependability that we require today. Even if it were technically possible, it might not be politically acceptable, since the Internet is now controlled by an international consortium, many of whose members like it the way it is.

That's why it is time to build a second Internet that is safe and reliable. Our current system is well optimized for speed, openness, and rapid innovation. The second Internet needs to be optimized for security and dependability. It would not replace the first but, rather, would operate alongside it. Nor would it have to be a multibillion-dollar government project. It might use the same fibers as the current Internet, but its protocols would be different, designed from the beginning to be less vulnerable to accidental failure or attack.

At first, this second network would carry special traffic that needs to be dependable, like the communications required for coordination of the electric grid. Its initial users would be utilities, hospitals, air traffic control, emergency services, and the banking system. People would use it for reliability and dependability, but eventually we could turn to it for other reasons too.

Since the second Internet would complement the first rather than replace it, its adoption could be gradual. All that's required to start is for an Internet service provider to offer an additional type of connection using a different set of protocols—protocols that reflect different priorities. Unlike traditional Internet service, this second service would support, among other things, a guaranteed minimal bandwidth, strong authentication on the origin of packets, and more controlled administration of the network. These features would probably come at the cost of reduced bandwidth efficiency, slower innovation, and less anonymity, but for some kinds of data, security is much more important than openness. Services that our lives depend on need a higher degree of certainty, but for social interaction, entertainment, and innovation, the free-for-all that is the current Internet would continue to thrive.



A global community of digital citizens will be more able and motivated to tackle threats.

Take Ownership

MITCHELL BAKER
Executive chairwoman, Mozilla

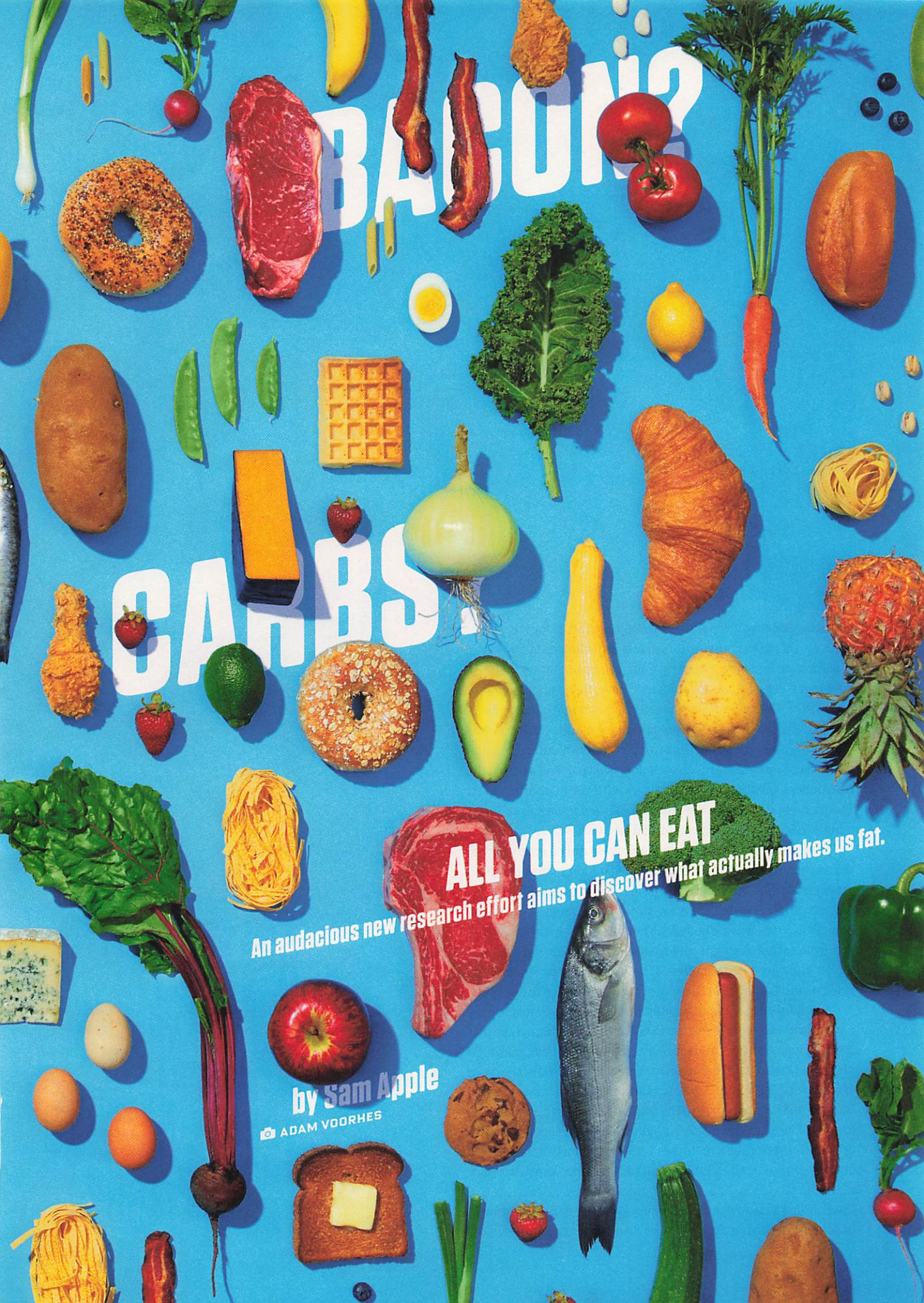
The Internet offers untold potential for humanity. To make the most of it, we need to think of the Internet as "ours." Yes, part of it belongs to commercial entities. Yes, part of it is the realm of government. But the heart of the Internet—the core of its vast possibilities—is individuals taking action, making things, solving problems, and ultimately building their own environment.

But today, that fundamental premise is at risk. Centralization has become the norm—the parameters of everything we do online are determined by a few large organizations. We've grown to accept the idea that the main activity of online life should be contributing content to platforms that someone else controls. The move toward centralization isn't only the impulse of commercial interests; in the regulatory world, there have been proposals to allow the United Nations' International Telecommunications Union to exert more control over the Internet. We risk creating an Internet where the possibilities are determined by the views of a few.

To save the Internet from this path, we need to do more to develop and empower digital citizens. This requires a strategy with a large grass-roots component, an educational element, and public policy to support both. At the grass-roots level, open source software and open content communities like Wikipedia (and similar ones for data, government, and science) encourage people to learn by doing. Our educational systems must develop teaching materials and methods that help students understand and create things, not just "fill in the blanks." This will require flexible methodologies and a big dose of learning by doing. Technology moves so fast that it's not realistic to expect our teachers to carry this load alone. We must commit resources and develop policies that prioritize this form of learning.

The good news is, being a digital citizen comes naturally to many of us once we get the opportunity—human beings have been taking things apart and putting them back together throughout history. There will always be threats to the Internet and its potential, but a global community of digital citizens will be more able and motivated to tackle those threats and recognize ones we can't foresee today. People are more naturally protective of what they create than of what they consume. Saving the Internet requires a greater sense of shared ownership and fewer bystanders accepting whatever today's Internet has to offer.

DAIRY?
SUGAR?



BACON? CARBS?

ALL YOU CAN EAT

An audacious new research effort aims to discover what actually makes us fat.

by Sam Apple

ADAM VOORHES

Gary Taubes

IN JANUARY OF THIS YEAR, the first subject checked into the metabolic ward at the National Institutes of Health in Bethesda, Maryland, to participate in one of the most rigorous dietary studies ever devised. For eight weeks, he was forbidden to leave. He spent two days of each week inside tiny airtight rooms known as metabolic chambers, where scientists determined precisely how many calories he was burning by measuring changes in oxygen and carbon dioxide in the air. He received meals through vacuum-sealed portholes so that the researchers' breath wouldn't interfere with their measurements. The food itself had been chemically analyzed to ensure an exact number of carbohydrate, protein, and fat calories.

The two-day stays in the chambers were only a small part of the testing, which was also being carried out on subjects at three other institutions around the US. Twice a month, the subjects were required to lie down for dual-energy x-ray absorptiometry scans, an accurate way to measure body fat. They offered up their veins again and again so that scientists could measure their lipids and hormone levels. They provided samples of their stools so the researchers could record the different colonies of bacteria residing in their guts.

And yet for all the poking, prodding, measuring, and testing, the most remarkable thing about the $5 million undertaking may be that it's designed to answer a question you'd think we'd have answered long ago: Do we get fat because we overeat or because of the *types* of food we eat? The Energy Balance Consortium Study, as it's called, is one of the first to be backed by the Nutrition Science Initiative, a nonprofit that prides itself on funding fanatically careful tests of previously overlooked hypotheses. NuSI (pronounced *new-see*) was launched in September 2012 by crusading science journalist Gary

THE INITIATIVE HAS AN AMBITIOUS GOAL: CUT THE PREVALENCE OF OBESITY IN THE U.S. BY MORE THAN HALF IN LESS THAN 15 YEARS.

Contributor **SAM APPLE** (samapple@gmail.com) *is the author of* Schlepping Through the Alps *and* American Parent.

Taubes and former physician and medical researcher Peter Attia. The three NuSI studies now under way, which focus on establishing the root causes of obesity and its related diseases, provide just a glimpse of Taubes and Attia's sweeping ambition. NuSI has already raised more than $40 million in pledges and is in the midst of a $190 million, three-year campaign to fund a new round of studies that will build off the findings in the initial research. Together, the studies are intended as steps toward an audacious goal: cutting the prevalence of obesity in the US by more than half—and the prevalence of diabetes by 75 percent—in less than 15 years.

NuSI's strategy is to bring the nation's top nutrition researchers together to find answers as a team. But arriving at a consensus about our nutrition woes won't be easy. Almost as striking as the grim health numbers themselves—two-thirds of American adults are now overweight or obese; more than 115 million Americans have diabetes or prediabetes—is that for all the thousands of studies and billions of dollars we've spent on research, there is no agreement among the experts on why we've grown so much more fat and sick over the past several decades or what we should do about it.

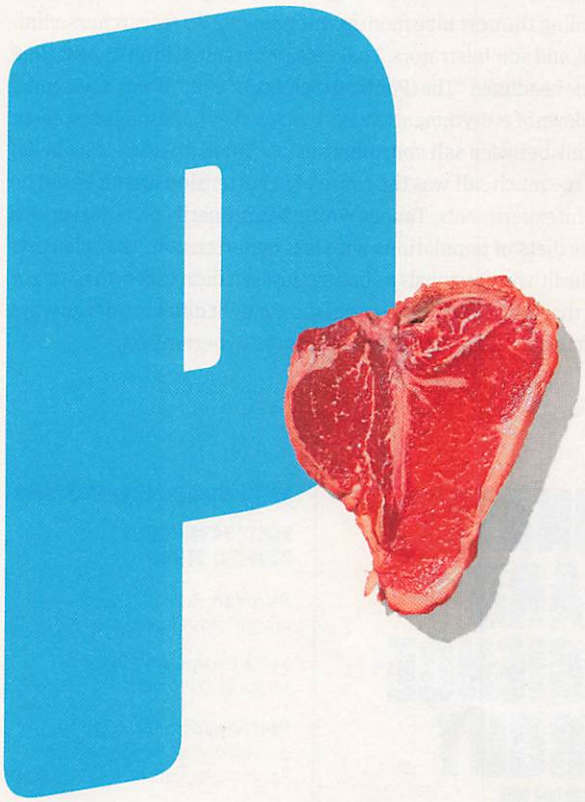
The standard explanation is that Americans eat too much—and especially too much fat, which for a long time was thought to be the underlying cause of obesity and most other chronic diseases. That's why major health organizations such as the American Heart Association and the American Cancer Society continue to recommend diets low in saturated fat, with prominent vegan doctors arguing that the answer to our problems lies in avoiding all animal products.

But in recent years, competing theories have suggested other culprits. A growing number of doctors and advocates now see decades of increased consumption of table sugar and other refined carbohydrates as the most likely explanation for our current epidemics. Robert Lustig, a pediatric endocrinologist, rose to national fame after a 2009 lecture in which he called sugar "poison" went viral on YouTube. (Lustig had a chance to repeat his case against sugar in the 2014 Katie Couric–produced documentary *Fed Up*.) Meanwhile, newer science has undermined the consensus that fat is all that bad for you. A recent meta-analysis published in the *Annals of Internal Medicine* found no clear evidence that eating saturated fat contributes to cardiovascular disease. This major study resonated across the cultural landscape, garnering a *Time* magazine cover ("Eat Butter") and a public reconsideration of the danger of fat by television host Dr. Mehmet Oz, who had previously preached against high-fat diets.

Taubes and Attia are firmly in the sugar-bad, saturated-fat-good camp. Indeed, Taubes has written a number of the articles and books—including the bestselling *Good Calories, Bad Calories*—on which that thinking is based. But even they acknowledge they can't be certain. That's because, as Taubes eloquently argues, most of the existing knowledge gathered in the past five decades of research comes from studies marred by inadequate controls, faulty cause-and-effect reasoning, and animal studies that are not applicable to humans. The whole body of literature, Taubes wrote in a blog post announcing the launch of NuSI, "is based on science that was simply not adequate to the task of establishing reliable knowledge."

For instance, much of what we think we know about nutrition is based on observational studies, a mainstay of major research initiatives like the Nurses' Health Study, which followed more than 120,000 women across the US for three decades. Such studies look for associations between the foods that subjects claim to eat and the diseases they later develop. The problem, as Taubes sees it, is that observational studies may show a link between a food or nutrient and a disease but tell us nothing about whether the food or nutrient is actually causing the disease. It's a classic blunder of confusing correlation with causation—and failing to test conclusions with controlled experiments. "Good scientists will approach new results like they're buying a used car," he says. "When the salesman tells you it's a great car, you don't take his word for it. You get it checked out."

NuSI's starting assumption, in other words, is that bad science got us into the state of confusion and ignorance we're in. Now Taubes and Attia want to see if good science can get us out.



PERHAPS IT'S NO SURPRISE that Taubes, 58, founded a project as daring and ambitious as NuSI. He has a well-deserved reputation for being tough-minded and combative. (His detractors in nutrition science have long accused him of hubris.) He majored in applied physics at Harvard, where he also played on the football team's defensive line. (John Tuke, one of his teammates, recalls that Taubes stood out for his intensity.) After Harvard, Taubes headed to Stanford for a master's in engineering with visions of becoming an astronaut. It was only after realizing that NASA wasn't likely to send a man of his size to space—Taubes is 6′ 2″ and 220 pounds—that he decided to pursue an interest in investigative reporting that had been sparked by reading *All the President's Men*.

He attended Columbia University's Graduate School of Journal-

PETER YANG

ism and soon landed a job at *Discover* magazine. He caught a break in 1984, when a profile of particle physicist Carlo Rubbia led to a deal for his first book, *Nobel Dreams*. Taubes thought he would be documenting a breakthrough in physics. Instead, the book chronicled Rubbia's errors and the machinations he used to outmaneuver his fellow physicists. Taubes was struck that science could be so subjective at the highest levels—that it's not just the big mistakes that scientists have to worry about but the numerous small ones that accumulate to support their misconceptions. "You can be fooled in a thousand subtle ways," he says.

That lesson stuck with him when, almost by accident, he turned his attention to nutrition science in 1997. By then a freelancer and running low on rent money, he called his editor at *Science* and asked if there were any assignments he could turn around quickly. The editor mentioned a paper in *The New England Journal of Medicine* that detailed a dietary approach to reducing blood pressure without restricting salt. Maybe he could write about that?

Taubes knew almost nothing about the topic. He would end up spending the next nine months interviewing 80 researchers, clinicians, and administrators. That research resulted in an August 1998 article headlined "The (Political) Science of Salt." It was a sweeping takedown of everything scientists thought they had established about the link between salt consumption and blood pressure. The belief that too much salt was the cause of hypertension wasn't based on careful experiments, Taubes wrote, but primarily on observations of the diets of populations with less hypertension. The scientists and health professionals railing against salt didn't seem to notice or care that the diets of those populations might differ in a dozen ways from the diets of populations with more hypertension.

2002

2007

2014

Taubes' 2002 article in *The New York Times Magazine* led to a book on diet and nutrition. Its assertions have been backed up recently by additional studies.

Taubes began to wonder if his critique applied beyond salt, to the rest of nutrition science. After all, one of the researchers Taubes interviewed had taken credit not only for getting Americans to eat less salt but also for getting them to eat less fat and eggs. He kicked off a multiyear research project that culminated in 2002, when he published a *New York Times Magazine* cover story on fat that would vault him into prominence and onto the path to NuSI.

Under the cover line "What if Fat Doesn't Make You Fat?" Taubes made the case that we get fat not because we ignore the advice of the medical establishment but because we follow it. He argued that carbohydrates, not fat, were more likely to be the cause of the obesity epidemic. The piece was a sensation. "Gary Taubes is ruining my life!" one NYU professor of nutrition, Marion Nestle, complained to *Popular Science* at the time. "I can't go anywhere without someone asking about that damn article."

"I lost friends over that story," Taubes says. "One journalist friend who had written a book about obesity accused me of having a brain transplant."

The *Times* article led to a $700,000 deal for what would become *Good Calories, Bad*

FINALLY: HARD SCIENCE ABOUT DIET

NuSI was founded on the principle that existing obesity research is rife with error, bad methodology, and flawed assumptions. So NuSI-sponsored scientists are conducting their own elaborate studies in an effort to definitively establish what's making us so fat and how diet affects health. Here's a look at three studies in the works. —VICTORIA TANG

BOSTON CHILDREN'S HOSPITAL STUDY

Purpose: Assessing weight-loss maintenance

Time frame: July 2013 to June 2017

Participants: 150 overweight and obese college students, faculty, and staff

Question: Does the macronutrient content of diet—proportion of carbs, fat, and protein—affect fat storage?

Procedure: Subjects live in dormitories for observation. They first lose about 12 percent of their weight on a diet that restricts all calories equally. Then they are randomly assigned one of three diets, with varying proportions of carbs and fat. Scientists closely monitor the subjects for physiological change.

Cost: $13.6 million

ENERGY BALANCE CONSORTIUM STUDY

Purpose: Monitoring energy expenditure and appetite

Time frame: September 2013 to December 2014

Participants: 17 overweight and obese males, ages 18 to 50

Question: Does altering carbs and fat in the diet affect calories burned or cause hormonal changes?

Procedure: After four weeks of a standard diet designed to maintain weight, subjects make a drastic switch to a ketogenic diet (5 percent carbs, 80 percent fat) with the same number of calories. If Taubes' hypothesis holds, the change in diet should reduce fat mass and be accompanied by increased energy output.

Cost: $5 million

STANFORD UNIVERSITY STUDY

Purpose: Testing diets in the real world

Time frame: March 2013 to December 2016

Participants: 600 overweight and obese subjects, ages 18 to 50

Question: What effect do low-carb and low-fat diets, along with genetic and clinical differences, have on weight loss?

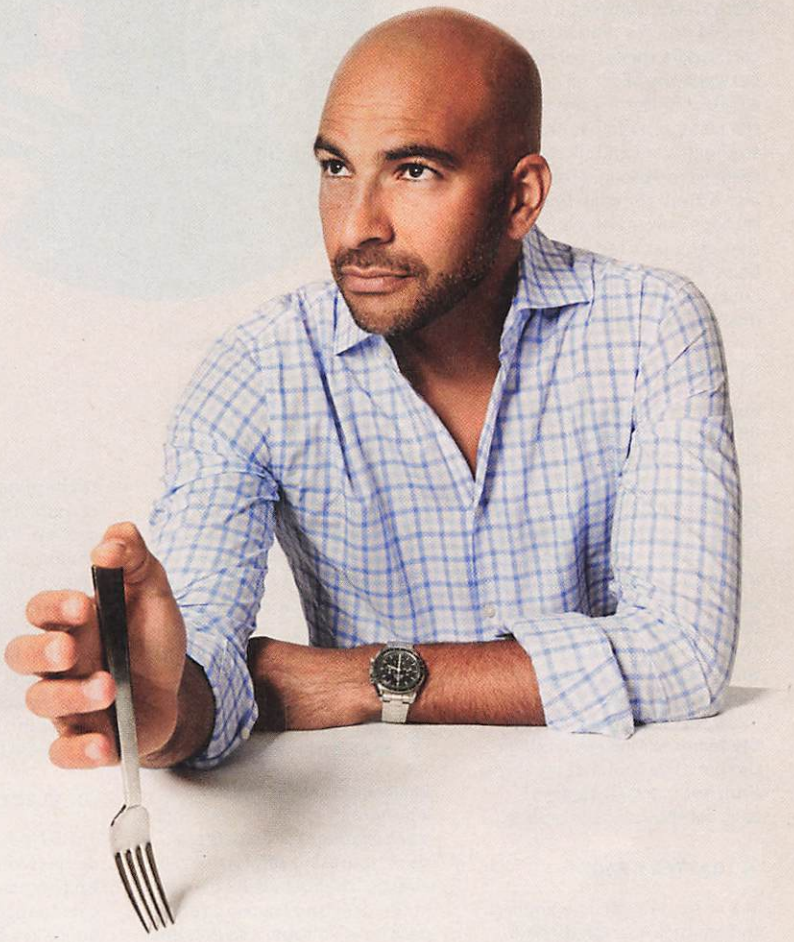
Procedure: In a large so-called free-living study, participants are put on either an extremely low-fat or low-carb diet but are allowed to eat as much protein (and carbs or fat, respectively) as desired. To track daily routines over 12 months, NuSI is developing a smartphone app to monitor eating habits and compliance.

Cost: $7.4 million

Calories, and Taubes spent the next five years plowing through late-19th- and 20th-century nutrition research. In doing so, he found himself drawn to an even more radical theory, the so-called alternative hypothesis, which holds that we get fat not because we eat too many calories but because specific kinds of calories trigger hormones that regulate how our fat cells behave. In particular, eating refined carbohydrates, and especially sugar, on a sustained basis leads to chronically elevated insulin levels. Among its many other crucial functions in the body, insulin tells fat cells to take up glucose, which is converted into fat, and then keeps fat from all sources locked inside. Therefore: Consume a bunch of sugar every day, as most Americans do, and you'll get fat.

Of course, Taubes could only present the hypothesis. He couldn't *prove* any of it. The right experiments had never been done.

EVEN SKEPTICAL SCIENTISTS ARE EAGER TO WORK ON THE NEW STUDIES. ONE REASON: GENEROUS FUNDING.

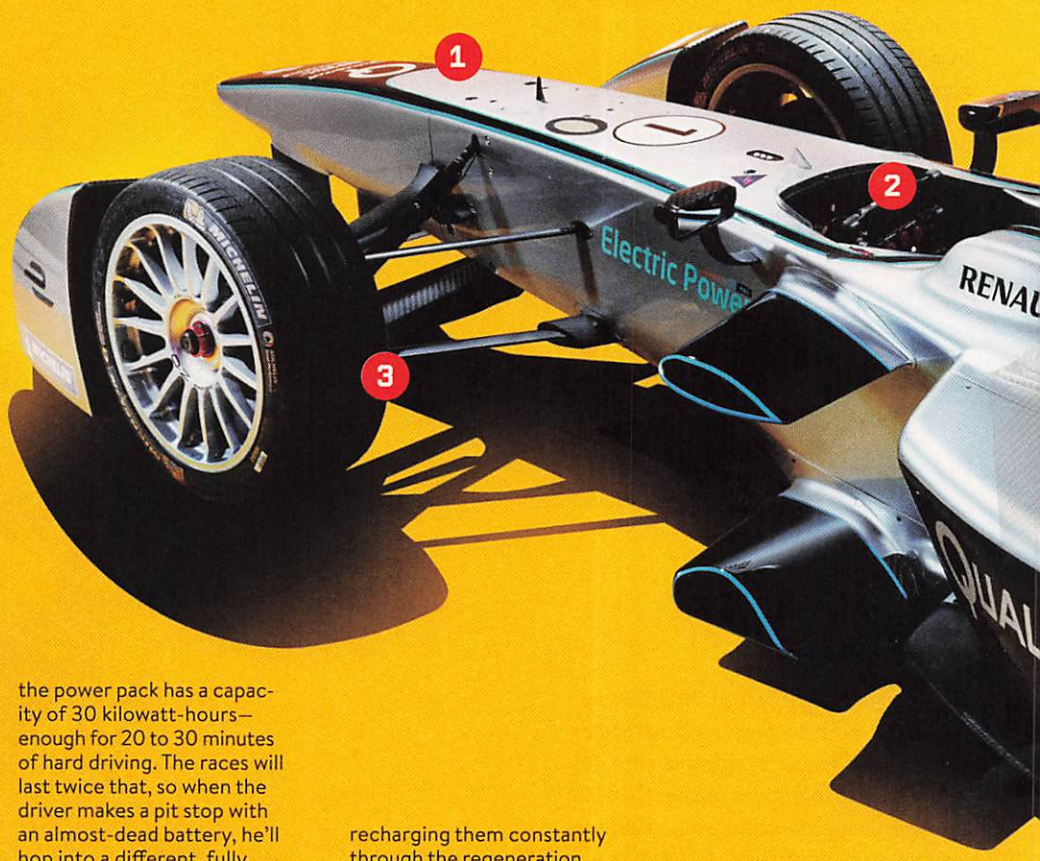


Peter Attia

BY THE TIME Peter Attia read *Good Calories, Bad Calories,* he already sensed that something was off about nutrition science. He didn't have to look much farther than his own waistline. Attia had taken up endurance swimming in his thirties. (In 2008, at age 34, he became the first person to swim from Maui to Lanai and back.) And yet despite exercising for three to four hours a day and watching what he ate, he'd become fat.

At age 35, Attia weighed 205 pounds, 45 more than he did in high school. Alarmingly, his blood work suggested he was on the path to heart disease. Fearing for his future and out of conventional options, in late 2009 Attia began eliminating more and more carbs from his diet while adding more and more dietary fat. Over the next two years, his waist shrank from 36 to 31 inches. His triglycerides, an indicator of cardiovascular risk, dropped from 154 to 22. His HDL (the so-called good cholesterol) rose from 31 to 85 | CONTINUED ON PAGE 120

TERMINAL VELOCITY



1 CHASSIS

Built by the Italian firm Dallara, which also makes the chassis for Indy cars, the Formula E chassis is made of a strong, lightweight carbon-fiber composite. As in a typical F1 car, the driver sits in an aluminum tub for better crash protection.

2 STEERING WHEEL

This is the command center. Many of the controls are what you'd find on a typical race car: paddle shifters for flicking between the SRT's six gears, a speed limiter for driving in the pit lane, a radio button so the driver can talk to his team. Here, though, there's also a knob for adjusting the motor's power and a button that engages a temporary boost for passing. And, of course, a screen displays how much juice is left in the battery.

3 TIRES

Formula E tires must be both efficient and versatile, since the cars will be racing not on dedicated racetracks but on city streets. Michelin designed an 18-inch tire that's treaded for all-weather performance—a first for an international race series—with low rolling resistance to extend battery life. The're so rugged that they won't need to be changed mid-race, which makes the series more sustainable and also saves the teams some cash—a single tire gun (the tool that removes a lug nut in a split second) can cost thousands of dollars.

4 BATTERY PACK

In a normal F1 car, the engine and gas tank are right behind the driver. Here that space is occupied by a roughly 772-pound cube containing 164 lithium-ion batteries. Designed by the British firm Williams F1, the power pack has a capacity of 30 kilowatt-hours—enough for 20 to 30 minutes of hard driving. The races will last twice that, so when the driver makes a pit stop with an almost-dead battery, he'll hop into a different, fully charged car. Right now all the battery packs are the same, but to encourage innovation, this stricture may eventually be relaxed, allowing teams to experiment with different suppliers to gain an edge.

5 BATTERY MANAGEMENT SYSTEM

In any electric car, the BMS is a bundle of hardware and software that keeps the battery pack operating safely and reliably by balancing the charges in the cells and tracking temperature, voltage, and current. Here it's even more crucial, because racing demands more of each cell, draining them much more rapidly than in an electric passenger car and recharging them constantly through the regeneration system. Williams crammed the BMS with many more sensors than usual, allowing it to monitor conditions at a greater level of detail; each second, the unit captures some 350,000 inputs that help the software maximize the health and performance of the battery pack.

6 ELECTRIC MOTOR

The 57-pound cylindrical motor comes from McLaren, the British company famous for supercars that cost more than a nice house in a good school district. This is the same motor that McLaren uses in its $1.5 million P1 hybrid. Although the P1 has a higher top speed (217 mph as opposed to the Spark-Renault's 140 mph), electric motors have a lot of low-end torque, so the SRT_01E and the P1 both catapult from 0 to 60 in less than three seconds. One important feature is the motor's regeneration system: Whenever the driver takes his foot off the throttle, the spinning rotor charges the battery pack. The motor also helps produce the car's unique, pod-racer-esque sound; at top speed, the car hums at 80 decibels, compared with the 130-decibel scream of its gas-fueled Formula 1 brethren.

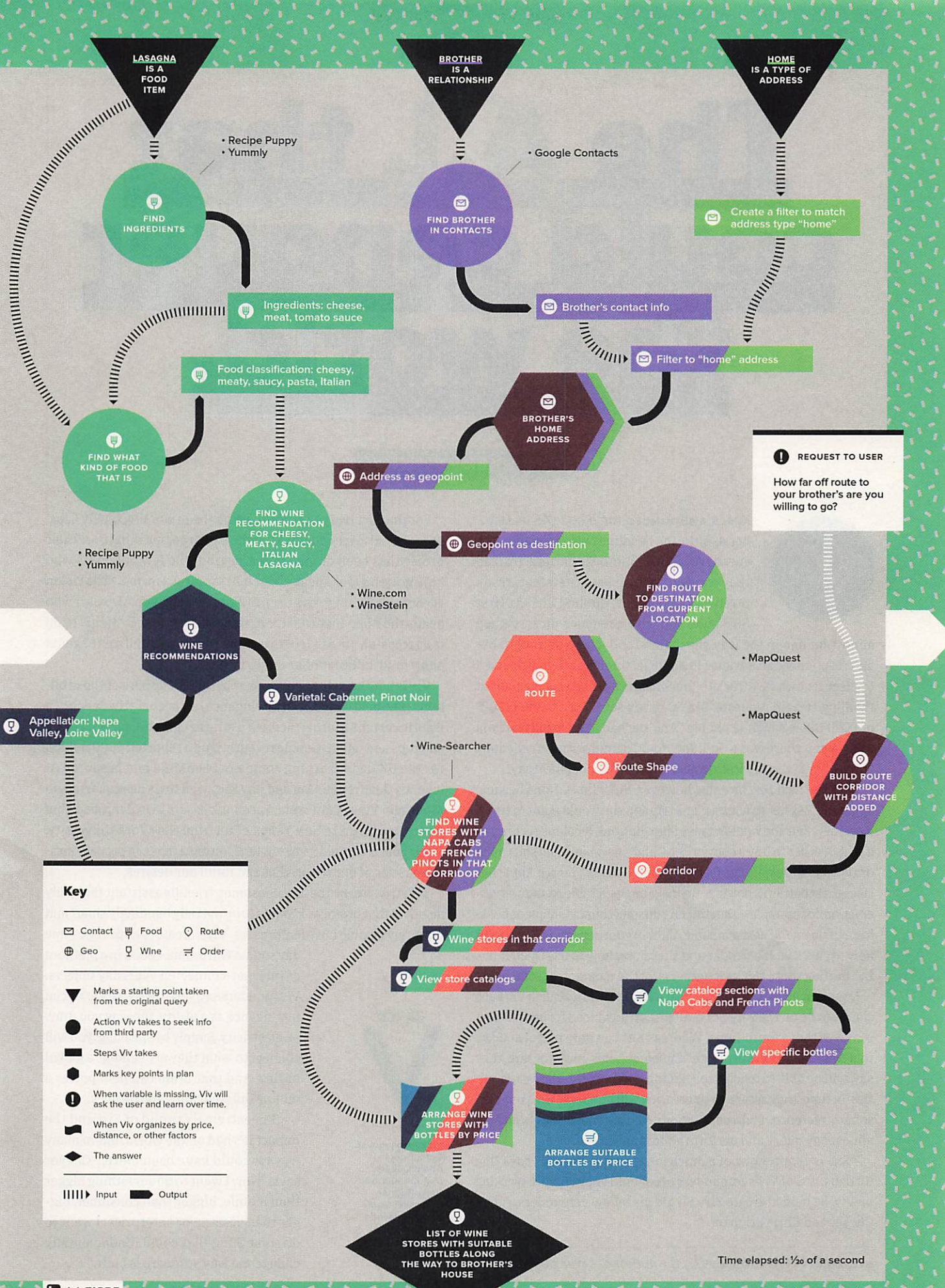
THE BATTERY-POWERED ROCKET THAT COULD TRANSFORM FORMULA 1 RACING.

Much of high-end auto racing has always been about squeezing a bit more kinetic energy out of each drop of gasoline. But improvements in electric car technology mean racing can ditch the fossil fuels. Starting in September, the new FORMULA E series will bring teams from around the world to compete on the streets of Beijing, Monte Carlo, Buenos Aires, Miami, and six other cities. And they'll all be driving a version of the same car: the Spark-Renault SRT_01E. Built using systems from several storied automotive firms, the 1,764-pound electrorocket represents the thinking of the best minds in the sport. Carmakers hope that new ideas will emerge from the crucible of racing to zoom all electric vehicles forward.

BY JASON FAGONE | WILSON HENNESSY | BRYAN CHRISTIE DESIGN

On the way to my brother's house, I need to pick up some cheap wine that goes well with lasagna.*

*VIV CAN HELP


LASAGNA IS A FOOD ITEM
BROTHER IS A RELATIONSHIP
HOME IS A TYPE OF ADDRESS
• Recipe Puppy
• Yummly
• Google Contacts
FIND INGREDIENTS
FIND BROTHER IN CONTACTS
Create a filter to match address type "home"
Ingredients: cheese, meat, tomato sauce
Brother's contact info
Filter to "home" address
Food classification: cheesy, meaty, saucy, pasta, Italian
BROTHER'S HOME ADDRESS
FIND WHAT KIND OF FOOD THAT IS
Address as geopoint
REQUEST TO USER
How far off route to your brother's are you willing to go?
FIND WINE RECOMMENDATION FOR CHEESY, MEATY, SAUCY, ITALIAN LASAGNA
Geopoint as destination
• Recipe Puppy
• Yummly
• Wine.com
• WineStein
FIND ROUTE TO DESTINATION FROM CURRENT LOCATION
WINE RECOMMENDATIONS
• MapQuest
ROUTE
Varietal: Cabernet, Pinot Noir
Appellation: Napa Valley, Loire Valley
• MapQuest
• Wine-Searcher
Route Shape
BUILD ROUTE CORRIDOR WITH DISTANCE ADDED
FIND WINE STORES WITH NAPA CABS OR FRENCH PINOTS IN THAT CORRIDOR
Corridor
Key
Contact
Food
Route
Geo
Wine
Order
Marks a starting point taken from the original query
Action Viv takes to seek info from third party
Steps Viv takes
Marks key points in plan
When variable is missing, Viv will ask the user and learn over time.
When Viv organizes by price, distance, or other factors
The answer
Input
Output
Wine stores in that corridor
View store catalogs
View catalog sections with Napa Cabs and French Pinots
View specific bottles
ARRANGE WINE STORES WITH BOTTLES BY PRICE
ARRANGE SUITABLE BOTTLES BY PRICE
LIST OF WINE STORES WITH SUITABLE BOTTLES ALONG THE WAY TO BROTHER'S HOUSE
Time elapsed: 1/20 of a second

The A.I. that could conquer the world.

BY STEVEN LEVY

APPLE ANNOUNCED the iPhone 4S on October 4, 2011, the headlines were not about its speedy A5 chip or improved camera. Instead they focused on an unusual new feature: an intelligent assistant, dubbed Siri. At first Siri, endowed with a female voice, seemed almost human in the way she understood what you said to her and responded, an advance in artificial intelligence that seemed to place us on a fast track to the Singularity. She was brilliant at fulfilling certain requests, like "Can you set the alarm for 6:30?" or "Call Diane's mobile phone." And she had a personality: If you asked her if there was a God, she would demur with deft wisdom. "My policy is the separation of spirit and silicon," she'd say.

Over the next few months, however, Siri's limitations became apparent. Ask her to book a plane trip and she would point to travel websites—but she wouldn't give flight options, let alone secure you a seat. Ask her to buy a copy of Lee Child's new book and she would draw a blank, despite the fact that Apple sells it. Though Apple has since extended Siri's powers—to make an OpenTable restaurant reservation, for example—she still can't do something as simple as booking a table on the next available night in your schedule. She knows how to check your calendar and she knows how to use OpenTable. But putting those things together is, at the moment, beyond her.

Now a small team of engineers at a stealth startup called Viv Labs claims to be on the verge of realizing an advanced form of AI that removes those limitations. Whereas Siri can only perform tasks that Apple engineers explicitly implement, this new program, they say, will be able to teach itself, giving it almost limitless capabilities. In time, they assert, their creation will be able to use your personal preferences and a near-infinite web of connections to answer almost any query and perform almost any function.

"Siri is chapter one of a much longer, bigger story," says Dag Kittlaus, one of Viv's cofounders. He should know. Before working on Viv, he helped create Siri. So did his fellow cofounders, Adam Cheyer and Chris Brigham.

STEVEN LEVY (@stevenlevy) *is the author of seven books.*

For the past two years, the team has been working on Viv Labs' product—also named Viv, after the Latin root meaning *live*. Their project has been draped in secrecy, but the few outsiders who have gotten a look speak about it in rapturous terms. "The vision is very significant," says Oren Etzioni, a renowned AI expert who heads the Allen Institute for Artificial Intelligence. "If this team is successful, we are looking at the future of intelligent agents and a multibillion-dollar industry."

Viv is not the only company competing for a share of those billions. The field of artificial intelligence has become the scene of a frantic corporate arms race, with Internet giants snapping up AI startups and talent. Google recently paid a reported $500 million for the UK deep-learning company DeepMind and has lured AI legends Geoffrey Hinton and Ray Kurzweil to its headquarters in Mountain View, California. Facebook has its own deep-learning group, led by prize hire Yann LeCun from New York University. Their goal is to build a new generation of AI that can process massive troves of data to predict and fulfill our desires.

Viv strives to be the first consumer-friendly assistant that truly achieves that promise. It wants to be not only blindingly smart and infinitely flexible but omnipresent. Viv's creators hope that some day soon it will be embedded in a plethora of Internet-connected everyday objects. Viv founders say you'll access its artificial intelligence as a utility, the way you draw on electricity. Simply by speaking, you will connect to what they are calling "a global brain." And that brain can help power a million different apps and devices.

Viv's icon (above). Cofounders Adam Cheyer, Dag Kittlaus, and Chris Brigham (opposite, from left) see a world where artificial intelligence is as ubiquitous as electricity.

"I'm extremely proud of Siri and the impact it's had on the world, but in many ways it could have been more," Cheyer says. "Now I want to do something bigger than mobile, bigger than consumer, bigger than desktop or enterprise. I want to do something that could fundamentally change the way software is built."

LABS IS TUCKED behind an unmarked door on a middle floor of a generic glass office building in downtown San Jose. Visitors enter into a small suite and walk past a pool table to get to the single conference room, glimpsing on the way a handful of engineers staring into monitors on trestle tables. Once in the meeting room, Kittlaus—a product-whisperer whose career includes stints at Motorola and Apple—is usually the one to start things off.

He acknowledges that an abundance of voice-navigated systems already exists. In addition to Siri, there is Google Now, which can anticipate some of your needs, alerting you, for example, that you should leave 15 minutes sooner for the airport because of traffic delays. Microsoft, which has been pursuing machine-learning techniques for decades, recently came out with a Siri-like system called Cortana. Amazon uses voice technology in its Fire TV product.

But Kittlaus points out that all of these services are strictly limited. Cheyer elaborates: "Google Now has a huge knowledge graph—you can ask questions like 'Where was Abraham Lincoln born?' And it can name the city. You can also say, 'What is the population?' of a city and it'll bring up a chart and answer. But you cannot say, 'What is the population of the city where Abraham Lincoln was born?'" The system may have the data for both these components, but it has no ability to put them together, either to answer a query or to make a smart suggestion. Like Siri, it can't do anything that coders haven't explicitly programmed it to do.

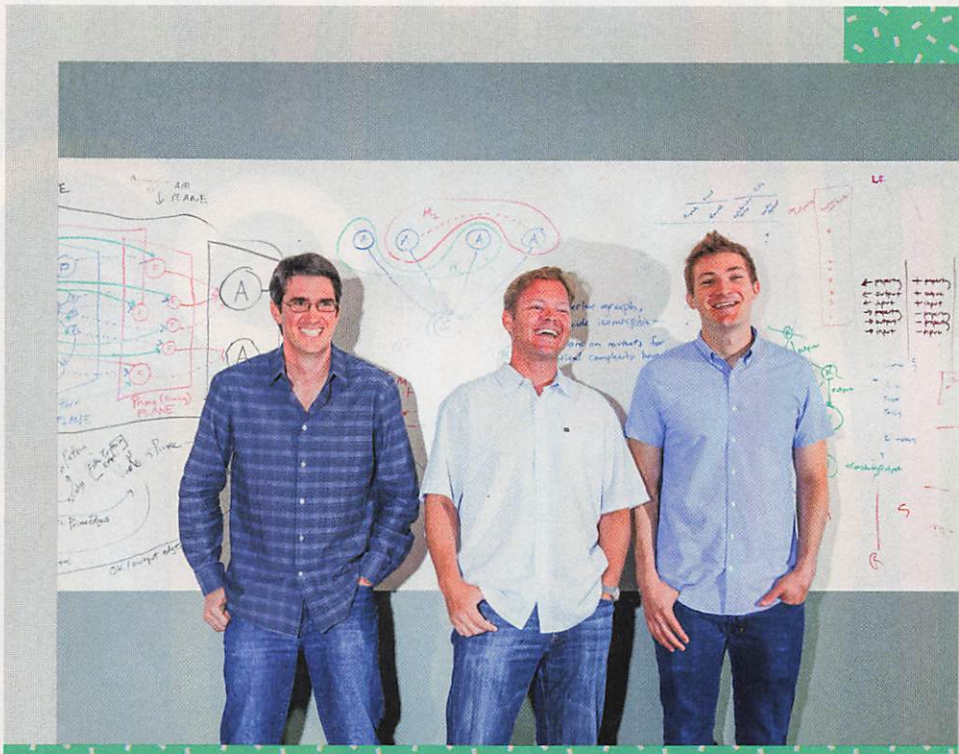
Viv breaks through those constraints by generating its own code on the fly, no programmers required. Take a complicated command like *"Give me a flight to Dallas with a seat that Shaq could fit in."* Viv will parse the sentence and then it will perform its best trick: automatically generating a quick, efficient program to link third-party sources of information together—say, Kayak, SeatGuru, and the NBA media guide—so it can identify available flights with lots of legroom. And it can do all of this in a fraction of a second.

Viv is an open system that will let innumerable businesses and applications become part of its boundless brain. The technical barriers are minimal, requiring brief "training" (in some cases, minutes) for Viv to understand the jargon of the specific topic. As Viv's knowledge grows, so will its understanding; its creators have designed it based on three principles they call its "pillars": It will be taught by the world, it will know more than it is taught, and it will learn something every day. As with other AI products, that teaching involves using sophisticated algorithms to interpret the language and behavior of people using the system—the more people use it, the smarter it gets. By knowing who its users are and which services they interact with, Viv can sift through that vast trove of data and find new ways to connect and manipulate the information.

Kittlaus says the end result will be a digital assistant who knows what you want before you ask for it. He envisions someone unsteadily holding a phone to his mouth outside a dive bar at 2 am and saying, "I'm drunk." Without any elaboration, Viv would contact the user's preferred car service, dispatch it to the address where he's half passed out, and direct the driver to take him home. No further consciousness required.

KITTLAUS IS IN some ways the Steve Jobs of Viv—he is the only non-engineer on the 10-person team and its main voice on strategy and marketing—Cheyer is the company's Steve Wozniak, the project's key scientific mind. Unlike the whimsical creator of the Apple II, though, Cheyer is aggressively analytical in every facet of his life, even beyond the workbench. As a kid, he was a Rubik's Cube champion, averaging 26 seconds a solution. When he encountered programming, he dove in headfirst. "I felt that computers were invented for me," he says. And while in high school he discovered a regimen to force the world to bend to his will. "I live my life by what I call verbally stated goals," he says. "I crystallize a feeling, a need, into words. I think about the words, and I tell everyone I meet, 'This is what I'm doing.' I say it, and then I believe it. By telling people, you're committed to it, and they help you. And it works."

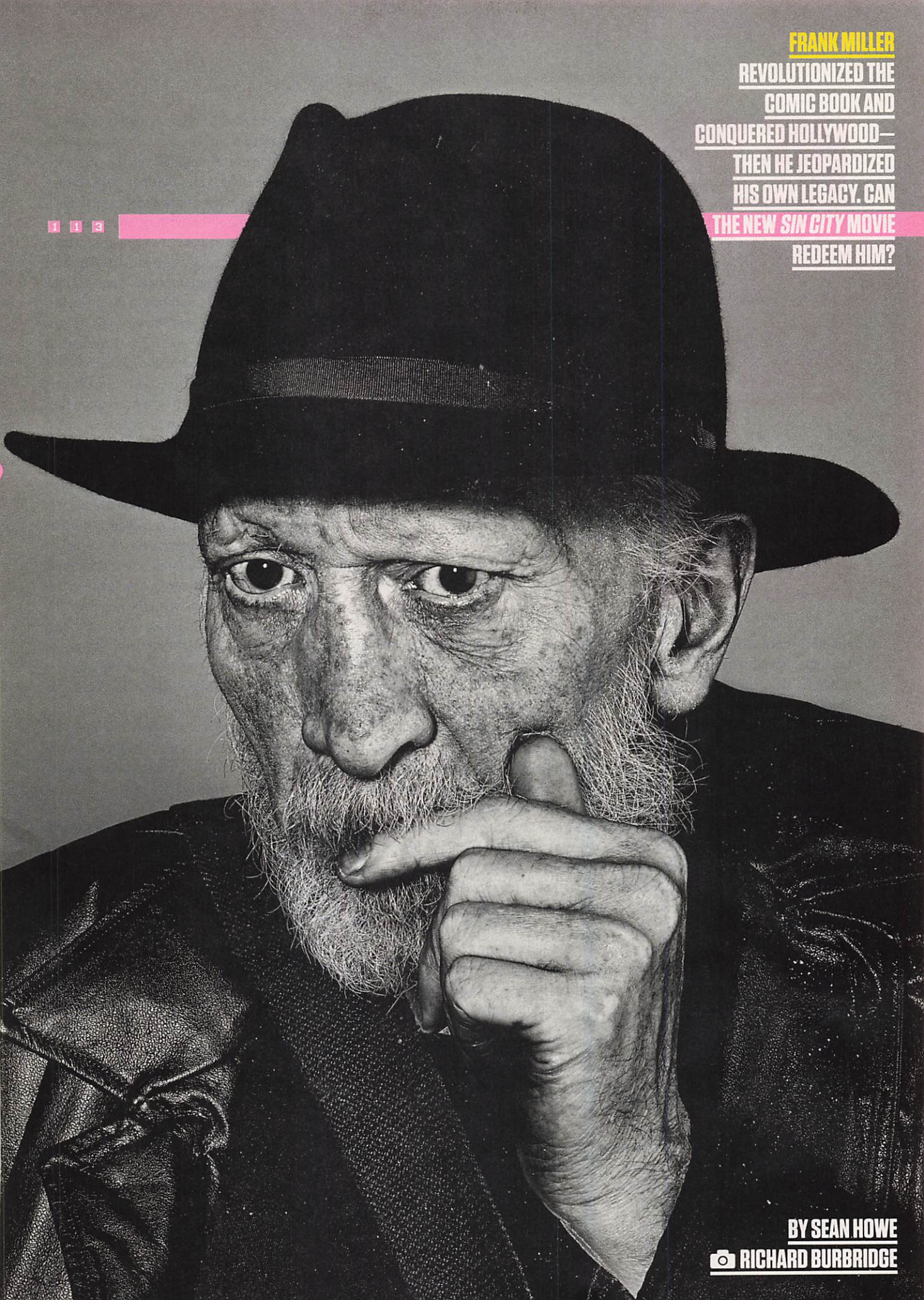
He says he used the technique to land his early computing jobs, including the most significant—at SRI International, a Menlo Park think tank that invented the concept of computer windows and the mouse. It was there, in the early 2000s, that Cheyer led the engineering of a Darpa-backed AI effort to build "a humanlike system that could sense the world, understand it, reason about it, plan, communicate, and act." The SRI-led | CONTINUED ON PAGE 121



ARIEL ZAMBELICH

THE DARKEST NIGHT

FRANK MILLER REVOLUTIONIZED THE COMIC BOOK AND CONQUERED HOLLYWOOD—THEN HE JEOPARDIZED HIS OWN LEGACY. CAN THE NEW *SIN CITY* MOVIE REDEEM HIM?



BY SEAN HOWE

RICHARD BURBRIDGE

WE SEE THE MIDDLE-AGED MAN CROUCHING IN PAIN, ALONE.

His clothes are torn, and one eye is swelling shut, but his fists are clenched. He is a hero. He is the Batman, as drawn by Frank Miller, and he is on the T-shirt that Frank Miller is wearing.

Miller smiles. He's sitting in his studio in the Hell's Kitchen neighborhood of Manhattan. He has a red-flecked beard and gentle, watery eyes, and his longish hair peeks out from under a straw hat. He's got a bad cough from a lingering cold. But don't let his frail carriage fool you. Miller possesses a brutal, muscular worldview—of vigilantes pushed to the edge by a fallen society—that has resonated throughout popular culture over the past three decades. His 1986 breakthrough, *Batman: The Dark Knight Returns*, recast the squeaky-clean superhero as a gritty urban warrior and helped comic-book trade paperbacks storm bookstores for the first time. He created the indie comic *Sin City*, a black-and-white noir anthology series that he later turned into a big-budget movie with codirector Robert Rodriguez. The film of his graphic novel *300* made Zack Synder an A-list director and engendered a spate of imposters seeking to recapture its blockbuster success. His characters are fighters, loners fueled by an inner sense of justice starkly at odds with the reality around them. They are often bloodied but always uncompromising.

And Miller's blunt morality wasn't confined to the page or screen. He distinguished himself as one of the most vocal and courageous forces in the comics industry, fighting corporate exploitation and censorship. But, as if Miller were one of his own antiheroes, his stark individualist philosophy has also led him down some lonely corridors. He's written graphic novels that many of his fans recoil from—including one that WIRED called "one of the most appalling, offensive, and vindictive comics of all time." And he followed that up with ferocious online musings that provoked an outcry, even from some of his most stalwart supporters. In recent years, he's withdrawn from the public eye.

Until now. In late August, Miller will return to the limelight as writer and codirector of *Sin City: A Dame to Kill For*, the sequel to the 2005 blockbuster that represents his last artistic and commercial success. A repeat performance is by no means guaranteed. The screenplay—which was adapted from his comic series along with new material—has been in the works for years. Its original October 2013 release date was pushed back almost a year. Even at the time of this writing, no scenes from the film were ready to be shared with a reporter. It's hard to be too pessimistic about a film that once again pairs Miller with Rodriguez and supplements its initial star-studded cast (Bruce Willis, Jessica Alba, and Mickey Rourke) with the likes of Joseph Gordon-Levitt and Eva Green—but the question is whether Miller can still marshal these forces to deliver a vision that enthralls rather than alienates.

For now, though, he's just a guy in his studio, talking about country music—which he's grown to cherish. Unsurprisingly, he's drawn to crusty rebels like Cash and Kristofferson. But he's most moved by the tender soprano of Emmylou Harris. He picked her version of Neil Young's "Wrecking Ball" during the filming of a key scene in the original *Sin City* movie; as he watched it, he wept. He particularly loves her work with Bob Dylan, like 1976's *Desire*. "He seems to just wig out—to go crazy, the way Bob Dylan does," Miller says. "But she keeps pulling him back in."

Miller had someone like that once, but they split up years ago. "Right now, there's nothing like an Emmylou, really," he says. "I'm much more of a solo act."

MILLER GREW UP IN RURAL Vermont with six siblings, and when he just couldn't stand all the commotion of a big family, he'd go play Tarzan on the 14 acres of land around his parents' house, climbing trees too high, falling through branches and onto rocks, and finally returning home a bloody mess. His mother, a former combat nurse, did not coddle him. "She would throw me in the bathtub—I was only 5 years old—wash off my head, give me butterfly stitches, and send me off to play again."

Between scrapes, he saw *The 300 Spartans* at the local cinema and learned about iron will in the face of impossible odds. Detective fiction—Mickey Spillane, Raymond Chandler, Dashiell Hammett—

FELIX PFÄFFLI

provided another model of fortitude. "This great universe of dark characters, with their long trench coats and big guns, and all the beautiful women, helped focus me," he says. So too did the work of Spillane admirer Ayn Rand, whose *Romantic Manifesto* legitimized heroic fiction for him. When he ran the high school newspaper, he used it to attack what he saw as the moral failings of his teachers. "And they couldn't stop me," he says, "because I knew how to use a printing press."

Miller moved to *Taxi Driver*-era New York City in 1976, a nervous, lanky hick, an Ichabod Crane in a land of "danger around every corner." Subsisting on peanut butter sandwiches and cheap hamburger meat, clutching a portfolio held together with stolen baling twine, he was met with rejection at every turn. *Go back to Vermont and pump gas*, people would tell him. He found work doing carpentry on a stranger's loft, but it turned out that the client was a cocaine dealer wanted by the Mafia. Miller walked in one morning to face "men with guns, pointed at me. The next thing I remember, I was three blocks away, breathing hard." It wasn't the last time city life would terrorize him.

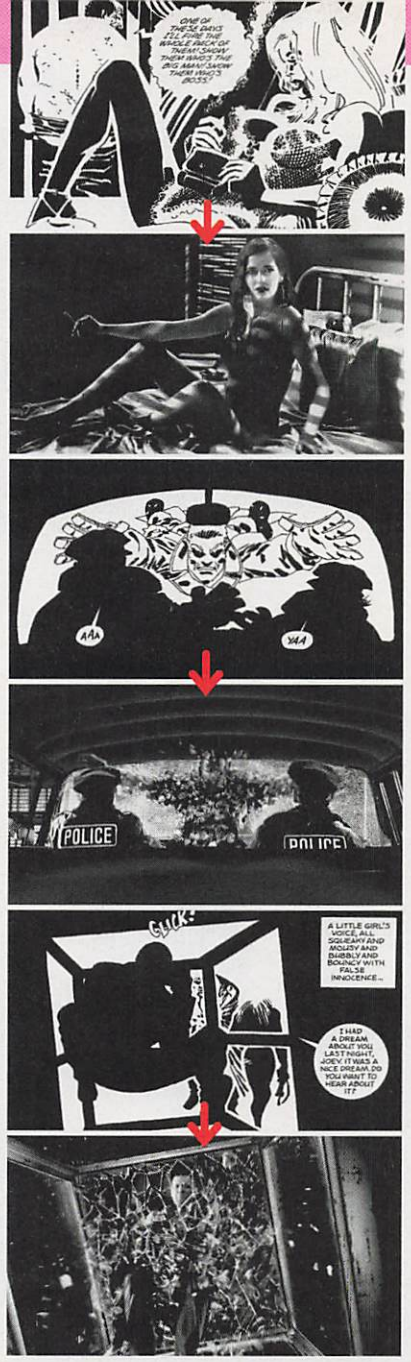
But he kept showing up at the studio of Neal Adams—his favorite Batman artist—for critiques. The intense, quiet kid listened as Adams patiently eviscerated Miller's pages of homemade black-and-white crime comics. "He told me that I was just no damn good, and I would never be any good," Miller says. "But my problem is I got fired from every other job I ever had. So it was either comics or nothing."

"It was like trying to stop a force of nature," Adams says. "He was a sponge. The last time he came, he'd gotten a six-page assignment, and I went over what he'd done wrong, how he could make it better. He said, 'You're saying I have to draw it over again.' I said, 'Well, yeah.' He said, 'OK, but the problem is, I turned it in, and they accepted it.' I said, 'In that case, don't draw it over again; I think you just started your career.'"

With that, Miller was off. In 1979 he landed a job as the regular penciler of *Daredevil* and soon began writing the series, making him a true rarity in the world of superhero comics: an artist who was also allowed to script. By the dawn of the '80s, *Daredevil*'s crisp dialog and inventive, cinematic cartooning had sent sales soaring and turned Miller into an industry star. "Frank was pioneering new territory, at the vanguard of what could happen with comics," says Jenette Kahn, the president and publisher of DC at the time. "So I called him up and asked him to lunch. I said, 'Tell me what you want to do; it doesn't matter how impossible you think it is.'"

Miller pitched *Ronin*, an anti-corporate sci-fi samurai tale that anticipated the cyberpunk zeitgeist of the 1980s. The ambitious project was a risk for DC: Miller enjoyed vastly increased creative autonomy as well as retaining copyright. "Frank didn't want to be loyal to one company just because he had worked for them," says Lynn Varley, who colored the series. "He wanted to break the system, much as Cary Grant had broken the Hollywood studio system." *Ronin* was all-consuming for Miller and Varley, both professionally and personally. Working in marathon sessions, they soon began dating and moved in together. When *Ronin* was released in the summer of 1983, the critical reception was glowing. Varley's painted colors gave Miller's art greater depth, as well as prestige. "It was about changing the entire industry," Kahn says, "putting up a signpost of what comics could be."

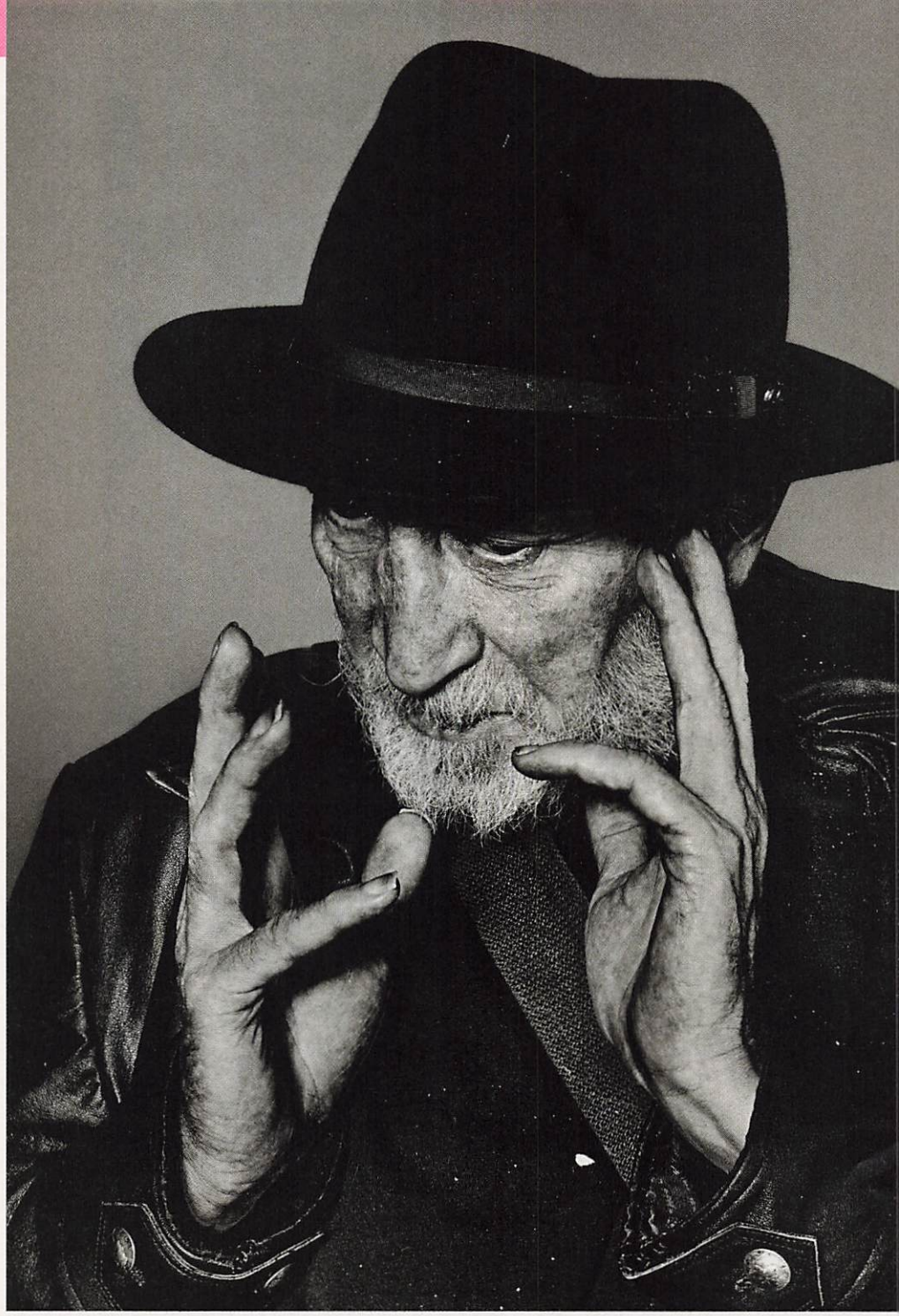
Yet even as Miller's career was taking off, the everyday violence in Manhattan at the time was taking its toll. "New York is no longer fit for human habitation," Miller told one friend. After enduring three robberies in the course of a month, he and Varley decided to escape to LA. While she went out west to search for a home, he stayed behind to set up more work to get them out of debt. He had a check in his pocket when, once again, someone tried to rob him. "Frank just went berserk on the guy," Varley says. "He didn't hit him



LIKE ITS PREDECESSOR, *SIN CITY: A DAME TO KILL FOR* IS LOVINGLY—AND PAINSTAKINGLY—ADAPTED FROM MILLER'S ORIGINAL WORK.

or anything, he just went so berserk the guy backed off and ran away. We were on edge."

That anxiety would fuel Miller's *Dark Knight*, which reimagined Batman as an embittered, bristle-haired 55-year-old ready for punks to make his day. Published in 1986, the year Miller and Varley married, it became a pop culture phenomenon, garnering lavish coverage from *Rolling Stone* and *Spin*. Reviewers and readers were particularly drawn to the dark reinterpretation of its campy source material. Along with Alan Moore's *Watchmen*, released the same year, *Dark Knight* gave comics a new respectability and gave the medium exposure beyond the dingy confines of newsstands and specialty stores. Together they cemented the viability of comics as literature and ushered in the current age of the conflicted superhero—*The Dark Knight* clearly inspiring Tim Burton's 1989 *Batman* movie and all the grittier films that followed in its wake. Miller was now a bona fide public figure. He'd already been the most vocal gadfly in comics circles—rallying troops to combat an MPAA-like ratings system, raising funds for retailers who'd been scapegoated by overzealous crusaders against obscenity—but this was different. It was mobbed-by-fans celebrity.



A few years after *Dark Knight*, however, Miller found himself at a professional crossroads. The success of the title "kind of flipped him out," Varley says. "Anyone who's had the excitement of success, what happens afterward is very confusing and very hard to sort through." Miller tried his hand at screenwriting—he worked on the scripts of two *RoboCop* sequels—but the films flopped and the Hollywood grind made him miserable. ("You've got to be always afraid of the deadly words 'I love you,'" he says, "which mean 'I've got the dagger in your back and I'm about to twist it.'")

But he would never fully leave the film industry. Over the next decades, as a generation weaned on his comics began to rise in the Hollywood ranks, interest in adapting his creations exploded: Artist Geof Darrow told Nerdist that the Wachowskis wanted to do an animated adaptation of Miller and Darrow's comic *Hard Boiled*, but Miller nixed it, holding out hopes for a live-action version with Nicolas Cage (Darrow and Miller now won't confirm this). Director Darren Aronofsky worked with Miller on adapting both *Ronin* and *Batman: Year One*. "Frank found the process of writing screenplays suffocating. He always came back from LA very upset and unhappy," Varley says. "You get beat up and insulted, but you get a really good check, and you go home to keep drawing comics."

Those comics remained the purest expression of Miller's vision. *Sin City* was born in 1991, when an out-of-practice Miller

---

SEAN HOWE (@louchelarue) *is the author of* Marvel Comics: The Untold Story. *He wrote about* Guardians of the Galaxy *in issue 22.08.*

picked up his pen and returned to the black-and-white crime tales he'd never been able to sell. It was as if everything—the backyard scrapes, Spillane and Rand, Daredevil and Batman, the heartbreak of writing for Hollywood—was distilled. In Miller's world, unlikely protagonists rise up against sinister forces and stare evil in the face. Loyalty is a virtue, but lovers rarely make for permanent allies, and old faces can signal danger. The hero, alone, is defined by excruciating physical tests, and his code allows for vengeance. Sometimes he survives.

But that need for vengeance could cause problems. At the turn of the millennium, Miller and Varley were working on their long-awaited *Dark Knight* sequel. It was initially hatched as a romp, a reinjection of Day-Glo fun into what had become a relentlessly grim superhero landscape. They were about halfway through the series on September 11, 2001. By this time Miller had moved back to New York, and the assault on his home disturbed him deeply—which again quickly became apparent in his work. In the later issues, Batman decides to let an alien force destroy Metropolis and its citizens, Captain Marvel is killed, and Batman kills a genetically manipulated Robin by hurling him into a lava-filled chasm. "I think there was a PTSD effect," Varley says of 9/11. "I think many people didn't get over it, that it will continue to affect their lives forever. And I think Frank is one of those people."

The Dark Knight Strikes Again was a critical disappointment. But Miller was undeterred; he described 9/11 in a 2003 interview with *The Comics Journal* as "the whole point of my work. I'm going to play around with doing some propagandizing." He began working on another Batman book, *Holy Terror, Batman!*, which pitted the caped crusader against al Qaeda.

Around that time, Rodriguez approached Miller with a plan to adapt *Sin City*. At first Miller resisted—he couldn't stomach the idea of ruining *Sin City* with studio notes and an outside director. Rodriguez cut him off. "I'm going to make it out of *my* studio," he promised Miller. "I'm going to write the script from *your* book." Most enticing of all, he offered Miller the chance to codirect the film with him. That did the trick.

Sin City, a production of Rodriguez's Troublemaker Studios, used greenscreen technology to meticulously re-create Miller's stark black-and-white panels, synthesizing a glowingly beautiful nightmare of a style as identifiably maverick as the original work. "With Robert," Miller says, "I discovered not just a good partner and a good friend—I found another brother." Perhaps emboldened by Rodriguez's behatted film-rebel persona, Miller soon began wearing his own hat—a fedora—for public appearances. There would be a lot of them: The film went on to gross more than $150 million worldwide.

It also reestablished Miller as a star. Private jets ferried him places; he rubbed elbows with boldface names. Soon after the *Sin City* premiere, Miller and Varley separated. Many of his friends in the comics industry haven't seen him in years. "Frank became even more famous than before, exposed to a kind of celebrity he'd never experienced," Varley says. "It was really distracting. You don't want to come back to Hell's Kitchen and just draw pictures. It seems like a letdown."

RED CARPET PHOTOS OF Frank Miller are abundant. In one, taken at the *Sin City* premiere, he looks like an energetic man at the top of his game. His eyes are bright, and his clean-shaven face seems almost boyish as he mugs for photographers and fans.

Looking at Miller now, it's hard to believe that was just nine years ago. He's only 57, but his face is gaunt; his eyes smolder rather than blaze. In 2012, after he canceled an appearance due to injury, a columnist for Portland's *Oregonian* mentioned rumors that the writer "is really struggling with health and dependency issues" and that "friends and colleagues are fearing the worst." Miller has no comment.

His professional standing took a serious hit in 2008, the year after Zack Snyder's meticulous adaptation of *300* earned $456 million. Miller had been hired to make a film of Will Eisner's seminal '40s vigilante comic *The Spirit*. "It was a very hot property to have Frank Miller attached," says *Spirit* producer Deborah Del Prete.

But *The Spirit* fell prey to a danger that *Sin City* had flirted with—that the faithful application of comic-strip language to

THE MILLER MILL

***Sin City: A Dame to Kill For* signals Frank Miller's return to adapting his work for the big screen. But for every project Miller's involved in, there's another out there he's inspired.**
—JASON KEHE

CHRISTOPHER NOLAN'S *DARK KNIGHT* TRILOGY

Nolan's Batman stems from Miller's Dark Knight not just in name—his subplots (Bruce Wayne retiring) and character arcs (especially the Joker) come directly from the '80s miniseries.

ZACK SNYDER'S CAREER

After his 2007 panel-to-frame adaptation of *300*, Zack Snyder basically internalized Miller's aesthetic. See: the high-saturation gloss of *Sucker Punch*, the visual splash page that was *Man of Steel*, and—judging from interviews—2016's *Batman v Superman: Dawn of Justice*.

THE WOLVERINE

Hugh Jackman didn't go to Japan for fun—that was the setting of Miller's '80s Wolverine comic with Chris Claremont. Jackman had been eager to adapt it for years, and the 2013 movie borrowed a number of characters from the story.

TMNT

The original *Teenage Mutant Ninja Turtles* was created as a parody of '80s ninja comics—specifically Miller's work on *Ronin* and *Daredevil*.

EVERETT COLLECTION

film could veer into stultification. Miller's sensibility, so often pitch-perfect, seemed needlessly dark in the lighter world that Will Eisner had created. The results were messy. Divorced from the panel flow of a comic-book page, the fussily composed frames and staccato bursts of one-liners vanquished most traces of humanity. When it was released, Miller's solo debut as a filmmaker was ravaged by critics and ignored at the box office.

"We all thought Frank had his own following and that they'd be true to him regardless," says Del Prete. "But that was wrong."

That became even more apparent when issues of his widely panned series *All-Star Batman & Robin, the Boy Wonder*—which featured a gratuitously sadistic Batman—stopped appearing in 2008. Then, in September 2011, Miller finally published *Holy Terror*, the graphic novel that had been percolating for a decade. By then the project had left DC's development pipeline, and Miller had redrawn it without the Batman. Frenetic and vicious, *Holy Terror* portrayed a cowardly American populace, a corrupt government, and a protagonist who gloated while committing torture on Muslims. What were readers being rallied to do, exactly? If a piece of propaganda is to be judged by how many it persuades or even by the coherence of its message, then *Holy Terror*'s failure was profound. The reviews, and the response from fans, were unforgiving.

"People attacked my city," Miller says today. "They killed my neighbors. I *despise* them. And I want them destroyed ... If people think that's somehow reactionary or overly conservative, that's their problem. Let them have their neighbors murdered and see what it feels like."

Despite the uproar, Miller didn't exactly back down. Instead he followed up *Holy Terror* with a startling anti-Occupy rant on his personal website. "Wake up, pond scum," he wrote. "America is at war against a ruthless enemy. Maybe ... you've heard terms like al-Qaeda and Islamicism. And this enemy of mine—not of yours, apparently—must be getting a dark chuckle, if not an outright horselaugh—out of your vain, childish, self-destructive spectacle." His website—which he'd promoted as "a more direct, participatory way for us to stay in touch"—filled up with comments, over 11,000 of them. The site was abandoned soon thereafter, although the comment-section vituperation remains. "I used to be your biggest fan," reads the top-voted comment on the page. "You're now dead to me." Miller's comic-book contemporary, the avowedly anarchic writer Alan Moore, went even further. "Frank Miller is someone whose work I've barely looked at for the past 20 years," he told an interviewer. "I think that there has probably been a rather unpleasant sensibility apparent in Frank Miller's work for quite a long time."

Asked about it now, Miller is immovable:

So about that Occupy post ... it was about that time that your updates stopped.

My computer was disabled, so I've ... I've been offline. And I'm kind of enjoying it.

You're completely offline?

Completely, now.

Because of the Occupy thing?

No, it was computer problems. I haven't solved it.

You should get a better technician if you want to get back on.

[*A silent stare.*] I will.

On a July morning two months after our interview, Miller is standing before thousands of people who have crammed themselves into the San Diego Convention Center to pay fealty to their hero. It's Comic-Con, and he's here to promote *Sin City: A Dame to Kill For*. Codirector Robert Rodriguez sits to his right. Stars Jessica Alba, Rosario Dawson, and Josh Brolin fill out the rest of the panel. But Miller is clearly the big draw. Most fans haven't heard much from him since the dark days of 2011. If anyone here feels any lingering negativity, it's completely overwhelmed by excitement over what looks to be a return to form.

Miller seems in good spirits. He walks out onstage with a halting gait, but he's clean-shaven and seems almost youthful again. Seeing him in his black T-shirt and straw Panama hat, speaking before an army of admirers, it's easy to imagine him poised for yet another comeback. He mentions that he has more *Sin City* stories to tell and has a plateful of other projects in the works. But he and Rodriguez are already discussing *Sin City 3*—"so you'd better show up for this one," he says, "or else they won't pay for it." Meanwhile, the Syfy network has announced a series based on *Ronin*, and Netflix's 2015 *Daredevil* series appears to be based on the gritty '70s vision of New York City that was the backdrop of Miller's version.

For a self-declared solo act, Miller seems to thrive with this set of collaborators. Rodriguez, Alba, and Dawson all hail Miller's fine touch with actors, bringing out the best in them and helping them understand their characters. To hear Rodriguez tell it, Miller could be downright giddy at times, especially when he was pleased with a take. "Frank doesn't grin very often," Rodriguez says, "so if he had a big grin on his face, you knew you'd nailed it."

All in all, the afternoon has the celebratory feel of a hero's homecoming. Miller has struggled, but he's here now—and this crowd seems eager to welcome him back. As the panel ends, Rodriguez and the cast stand up and move away from the long table, but Miller sits there for a beat. Then he leans toward the microphone. "I'll be damned," he says, "if it takes us nine years until the next one." W

COLOPHON

HACKS THAT HELPED GET THIS ISSUE OUT:

Painfully learning the ins and outs of Squarespace; GadgetRab, the hacked robobunny; charging my iPad with 12 binder clips and a frayed cord; using boiling water to decontaminate a lice comb while camping; deploying frosted Oreos to make a birthday cake look like a giant Lego; Stephen King's Mr. Mercedes; putting duct tape on my motorcycle's rear fender to keep the taillight's positive lead from shorting out my main fuse; freezing a chicken carcass for double the chicken soup; using steam from the shower for skirt de-wrinkling.

WIRED is a registered trademark of Advance Magazine Publishers Inc. Copyright ©2014 Condé Nast. All rights reserved. Printed in the USA. Volume 22, No. 9. WIRED (ISSN 1059-1028) is published monthly by Condé Nast, which is a division of Advance Magazine Publishers Inc. Editorial office: 520 Third Street, Ste. 305, San Francisco, CA 94107-1815. Principal office: The Condé Nast Building, 4 Times Square, New York, NY 10036. S. I. Newhouse, Jr., Chairman; Charles H. Townsend, CEO; Robert A. Sauerberg, Jr., President; John W. Bellando, COO/CFO; Louis Cona, Chief Marketing Officer; Jill Bright, Chief Administrative Officer. Periodicals postage paid at New York, NY, and at additional mailing offices. Canada Post Publications Mail Agreement No. 40644503. Canadian Goods and Services Tax Registration No. 123242885 RT0001. Canada Post: Return undeliverable Canadian addresses to PO Box 874, Station Main, Markham, ON L3P 8L4.

POSTMASTER: Send address changes to WIRED, PO Box 37706, Boone, IA 50037-0662. For subscriptions, address changes, adjustments, or back issue inquiries: Please write to WIRED, PO Box 37706, Boone, IA 50037-0662, call (800) 769 4733, or email *subscriptions@WIRED.com*. Please give both new and old addresses as printed on most recent label. First copy of new subscription will be mailed within eight weeks after receipt of order. Address all editorial, business, and production correspondence to WIRED magazine, 4 Times Square, New York, NY 10036. For permissions and reprint requests, please call (212) 630 5656 or fax requests to (212) 630 5883. Visit us online at *www.WIRED.com*. To subscribe to other Condé Nast magazines on the web, visit *www.condenet.com*. Occasionally, we make our subscriber list available to carefully screened companies that offer products and services that we believe would interest our readers. If you do not want to receive these offers and/or information, please advise us at PO Box 37706, Boone, IA 50037-0662, or call (800) 769 4733.

WIRED is not responsible for the return or loss of, or for damage or any other injury to, unsolicited manuscripts, unsolicited artwork (including, but not limited to, drawings, photographs, and transparencies), or any other unsolicited materials. Those submitting manuscripts, photographs, artwork, or other materials for consideration should not send originals, unless specifically requested to do so by WIRED in writing. Manuscripts, photographs, artwork, and other materials submitted must be accompanied by a self-addressed, stamped envelope.

AT HOME IN THE WORLD

The new CNTraveler.com

CNTraveler.com

STARRING OUR LAUNCH PARTNERS DUBAI kate spade NEW YORK LAND ROVER Lufthansa THE RITZ-CARLTON®

All You Can Eat

CONTINUED FROM PAGE 105

even as his LDL (the arguably bad cholesterol) dropped from 113 to 59.

In April 2011, Attia sent an email to Taubes, asking a few questions about fructose versus glucose. They eventually agreed to meet at an Oakland, California, café. Attia came prepared with 20 pages of highly technical medical questions. The two men discussed their passionate interest in nutrition science and soon discovered a shared admiration of physicist Richard Feynman. Before long, they decided to start a new organization together. The Feynman Foundation, as it could be called, would recruit world-class scientists from different fields to review existing nutrition literature and create consensus statements.

But the more they discussed the idea, the more unlikely it seemed that mere reviews of the existing literature would be enough to change the consensus about diet. "We decided the only way to do this was to create this Manhattan Project–like entity where you bring in all these scientists and remove that one obstacle"—funding—"that is preventing them from doing what they really need to do," Attia says. "We wanted to just say, 'Go out and solve it.'"

"I'd been waiting for someone like Peter to come along for a long time," Taubes says.

In Attia, Taubes found a partner even more driven than he is. Attia, now a lean endurance cyclist, appears every bit as fit as Taubes. (Both men took up boxing in their youth.) Like Taubes, Attia had planned to study engineering before deciding to go into medicine.

Taubes and Attia's initial plan was to start slowly, raising money on nights and weekends. Then one day in November 2011 a former natural-gas trader named John Arnold sent Taubes a five-line email. He had heard Taubes on a podcast talking about the type of study that could help uncover the triggers of the obesity epidemic. Arnold was listening closely. "From the little I know about the science of nutrition," he wrote, "your study makes a lot of sense."

Taubes had never heard of Arnold. Some quick Googling revealed that he was something of a legend in his field. In 2007, at 33, he became the youngest billionaire in the country. He got his start at Enron before founding his own hedge fund, Centaurus Energy Master Fund, where he proved to be almost preternaturally prescient in making bets on gas prices. In May 2012 Arnold announced that he was closing his fund to focus on philanthropy. Later that month, the Laura and John Arnold Foundation gave NuSI a $4.7 million seed grant. An additional $35.5 million grant was announced last year. "The reason the research hasn't been done right, according to the scientists we've talked to," says Denis Calabrese, president of the foundation, "is that it's too expensive. And John and Laura said, 'Well, fine. Tell us how much it is, and let's do it right.'"

SO TAUBES AND ATTIA have the money and the mission, but what they emphatically don't have—they insist—are prebaked answers to the tough questions they are asking. They are leaving those up to some of the top names in nutrition research—many of whom, as it turns out, are highly dubious of the alternative hypothesis. Consider Kevin Hall, a senior investigator at the NIH's National Institute of Diabetes and Digestive and Kidney Diseases. Like other researchers in the Energy Balance Consortium, he agreed to work with NuSI only once he understood that the initiative would have no control over the study's design, conduct, or reporting.

A physicist by training, Hall has developed a mathematical model that can predict how different diets impact metabolism and body composition. According to Hall's model, the low-carb, low-insulin diet that the participants will eat in the second phase of the metabolic ward study should have at most a tiny effect on the total calories they burn. "I'm currently skeptical," Hall says of the alternative hypothesis.

Rudolph Leibel, one of the researchers working on the consortium study at Columbia, also has similar doubts—not least because his own research fully supports the calories-in/calories-out model, which holds that all calories have equal impact on our weight. When Leibel had participants in one study drink formulas with the same number of calories but hugely different proportions of fat and carbohydrates, he saw no difference in the amount of energy they burned.

Like Hall, Leibel makes no secret of his doubts about the alternative hypothesis. And considering the lack of love between Taubes and many in the nutrition research community, the most surprising aspect of NuSI may be that these skeptical scientists have agreed to work with the organization in the first place.

One likely explanation is money, or more specifically the science that money makes possible. NuSI is giving researchers an opportunity to carry out unusually ambitious work. The NIH might fund similar studies to the tune of a few hundred thousand dollars a year. "The NIH has a very limited amount of money at a time when science requires increasingly expensive research to answer much more sophisticated questions," says David Ludwig, a professor of nutrition at the Harvard School of Public Health and director of the New Balance Foundation Obesity Prevention Center at Boston Children's Hospital.

With coprincipal investigator Cara Ebbeling, Ludwig is overseeing a NuSI experiment that launched in July 2013. The $13.6 million study ($10.3 million of which comes from a NuSI grant) also tests the alternative hypothesis on 150 overweight and obese college students, faculty, and staff who are fed most of their meals under direct observation in the school's cafeteria.

In contrast with Hall and Leibel, Ludwig's previous work has supported the alternative hypothesis. And Ludwig is optimistic that NuSI-sponsored science may one day change the way many of us think about nutrition: "One key study could be the hammer that dislodges the loose brick in the prevailing paradigm."

IN MARCH 2013, Christopher Gardner, a professor of medicine and a director at the Stanford Prevention Research Center, began preparing for NuSI's first free-living study—where subjects aren't directly observed as they eat. One of the largest such human experiments ever to test a low-fat diet against a low-carbohydrate diet, Gardner's study stems from his previous research, which suggests a diet's effectiveness may be due to how insulin-resistant the dieter is at the outset. It will randomize 600 overweight-to-obese subjects into two groups. Both will receive regular counseling meant to help them stick to their diets, a standard practice in other free-living studies. But to overcome the major problem with such work—inaccurate accounts of consumption based on volunteers' food diaries—NuSI is funding the creation of an app that allows subjects to record their eating activity by selecting photos from an extensive database. (Because of confidentiality agreements with the developers, Attia wouldn't provide much detail on the app's features.)

The app is just one example of NuSI's ambition to rewrite the rules of nutrition research funding, take huge risks, and arrive at answers as quickly and unambiguously as possible. It's "go big or go home," says Attia, who runs NuSI's day-to-day operations.

Taubes, too, is aware of the risk. As Calabrese puts it, "Gary is advancing a study that may refute a theory he's built his career on. It may blow his theory right out of the water."

If that happens, or if NuSI fails to bring any clarity to our obesity epidemic, Taubes won't be totally unprepared. In the entryway of his home, just off the main foyer, there's a frame with two photos in it. In one, taken just before the start of an amateur boxing match, a young Taubes is standing, gloves at his side. In his tank top and boxing shorts, the muscular young man looks powerful enough to punch his way through anything. In the other photo, taken about two minutes later, Taubes is lying on his back unconscious. "It's my hubris protection," Taubes says. "Whenever I think I'm so cool I can do anything, it reminds me that I am not and that this is real life." W

Viv Labs

CONTINUED FROM PAGE 111

team built what it called a Cognitive Assistant that Learns and Organizes, or CALO. They set some AI high-water marks, not least being the system's ability to understand natural language. As the five-year program wound down, it was unclear what would happen next.

That was when Kittlaus, who had quit his job at Motorola, showed up at SRI as an entrepreneur in residence. When he saw a CALO-related prototype, he told Cheyer he could definitely build a business from it, calling it the perfect complement to the just-released iPhone. In 2007, with SRI's blessing, they licensed the technology for a startup, taking on a third cofounder, an AI expert named Tom Gruber, and eventually renaming the system Siri.

The small team, which grew to include Chris Brigham, an engineer who had impressed Cheyer on CALO, moved to San Jose and worked for two years to get things right. "One of the hardest parts was the natural language understanding," Cheyer says. Ultimately they had an iPhone app that could perform a host of interesting tasks—call a cab, book a table, get movie tickets—and carry on a conversation with brio. They released it publicly to users in February 2010. Three weeks later, Steve Jobs called. He wanted to buy the company.

"I was shocked at how well he knew our app," Cheyer says. At first they declined to sell, but Jobs persisted. His winning argument was that Apple could expose Siri to a far wider audience than a startup could reach. He promised to promote it as a key element on every iPhone. Apple bought the company in April 2010 for a reported $200 million.

The core Siri team came to Apple with the project. But as Siri was honed into a product that millions could use in multiple languages, some members of the original team reportedly had difficulties with executives who were less respectful of their vision than Jobs was. Kittlaus left Apple the day after the launch—the day Steve Jobs died. Cheyer departed several months later. "I do feel if Steve were alive, I would still be at Apple," Cheyer says. "I'll leave it at that." (Gruber, the third Siri cofounder, remains at Apple.)

After several months, Kittlaus got back in touch with Cheyer and Brigham. They asked one another what they thought the world would be like in five years. As they drew ideas on a whiteboard in Kittlaus' house, Brigham brought up the idea of a program that could put the things it knows together in new ways. As talks continued, they lit on the concept of a cloud-based intelligence, a global brain. "The only way to make this ubiquitous conversational assistant is to open it up to third parties to allow everyone to plug into it," Brigham says.

In retrospect, they were re-creating Siri as it might have evolved had Apple never bought it. Before the sale, Siri had partnered with around 45 services, from AllMenus.com to Yahoo; Apple had rolled Siri out with less than half a dozen. "Siri in 2014 is less capable than it was in 2010," says Gary Morgenthaler, one of the funders of the original app.

Cheyer and Brigham tapped experts in various AI and coding niches to fill out their small group. To produce some of the toughest parts—the architecture to allow Viv to understand language and write its own programs—they brought in Mark Gabel from the University of Texas at Dallas. Another key hire was David Gondek, one of the creators of IBM'S Watson.

Funding came from Solina Chau, the partner (in business and otherwise) of the richest man in China, Li Ka-shing. Chau runs the venture firm Horizons Ventures. In addition to investing in Facebook, DeepMind, and Summly (bought by Yahoo), it helped fund the original Siri. When Viv's founders asked Chau for $10 million, she said, "I'm in. Do you want me to wire it now?"

IT'S EARLY MAY, and Kittlaus is addressing the team at its weekly engineering meeting. "You can see the progress," he tells the group, "see it get closer to the point where it just works." Each engineer delineates the advances they've made and next steps. One explains how he has been refining Viv's response to "Get me a ticket to the cheapest flight from SFO to Charles de Gaulle on July 2, with a return flight the following Monday." In the past week, the engineer added an airplane-seating database. Using a laptop-based prototype of Viv that displays a virtual phone screen, he speaks into the microphone. Lufthansa Flight 455 fits the bill. "Seat 61G is available according to your preferences," Viv replies, then purchases the seat using a credit card.

Viv's founders don't see it as just one product tied to a hardware manufacturer. They see it as a service that can be licensed. They imagine that everyone from TV manufacturers and car companies to app developers will want to incorporate Viv's AI, just as PC manufacturers once clamored to boast of their Intel microprocessors. They envision its icon joining the pantheon of familiar symbols like Power On, Wi-Fi, and Bluetooth.

"Intelligence becomes a utility," Kittlaus says. "Boy, wouldn't it be nice if you could talk to everything, and it knew you, and it knew everything about you, and it could do everything?"

That would also be nice because it just might provide Viv with a business model. Kittlaus thinks Viv could be instrumental in what he calls "the referral economy." He cites a factoid about Match.com that he learned from its CEO: The company arranges 50,000 dates a day. "What Match.com isn't able to do is say, 'Let me get you tickets for something. Would you like me to book a table? Do you want me to send Uber to pick her up? Do you want me to have flowers sent to the table?'" Viv could provide all those services—in exchange for a cut of the transactions that resulted.

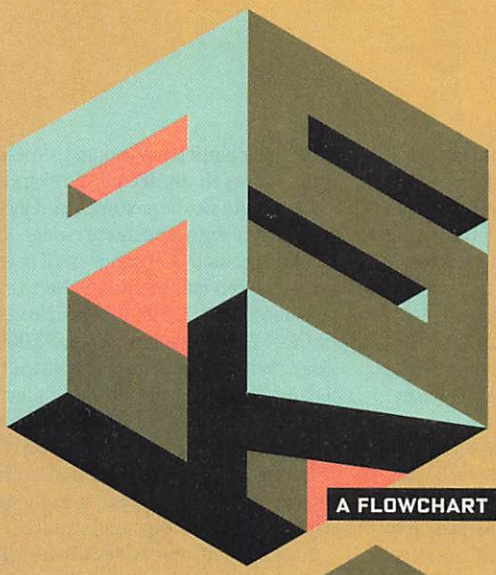
Building that ecosystem will be a difficult task, one that Viv Labs could hasten considerably by selling out to one of the Internet giants. "Let me just cut through all the usual founder bullshit," Kittlaus says. "What we're really after is ubiquity. We want this to be everywhere, and we're going to consider all paths along those lines." To some associated with Viv Labs, selling the company would seem like a tired rerun. "I'm deeply hoping they build it," says Bart Swanson, a Horizons adviser on Viv Labs' board. "They will be able to control it only if they do it themselves."

Whether they will succeed, of course, is not certain. "Viv is potentially very big, but it's all still potential," says Morgenthaler, the original Siri funder. A big challenge, he says, will be whether the thousands of third-party components work together—or whether they clash, leading to a confused Viv that makes boneheaded errors. Can Viv get it right? "The jury is out, but I have very high confidence," he says. "I only have doubt as to when and how."

Most of the carefully chosen outsiders who have seen early demos are similarly confident. One is Vishal Sharma, who until recently was VP of product for Google Now. When Cheyer showed him how Viv located the closest bottle of wine that paired well with a dish, he was blown away. "I don't know any system in the world that could answer a question like that," he says. "Many things can go wrong, but I would like to see something like this exist."

Indeed, many things have to go *right* for Viv to make good on its founders' promises. It has to prove that its code-making skills can scale to include petabytes of data. It has to continually get smarter through omnivorous learning. It has to win users despite not having a preexisting base like Google and Apple have. It has to lure developers who are already stressed adapting their wares to multiple platforms. And it has to be as seductive as Scarlett Johansson in *Her* so that people are comfortable sharing their personal information with a robot that might become one of the most important forces in their lives.

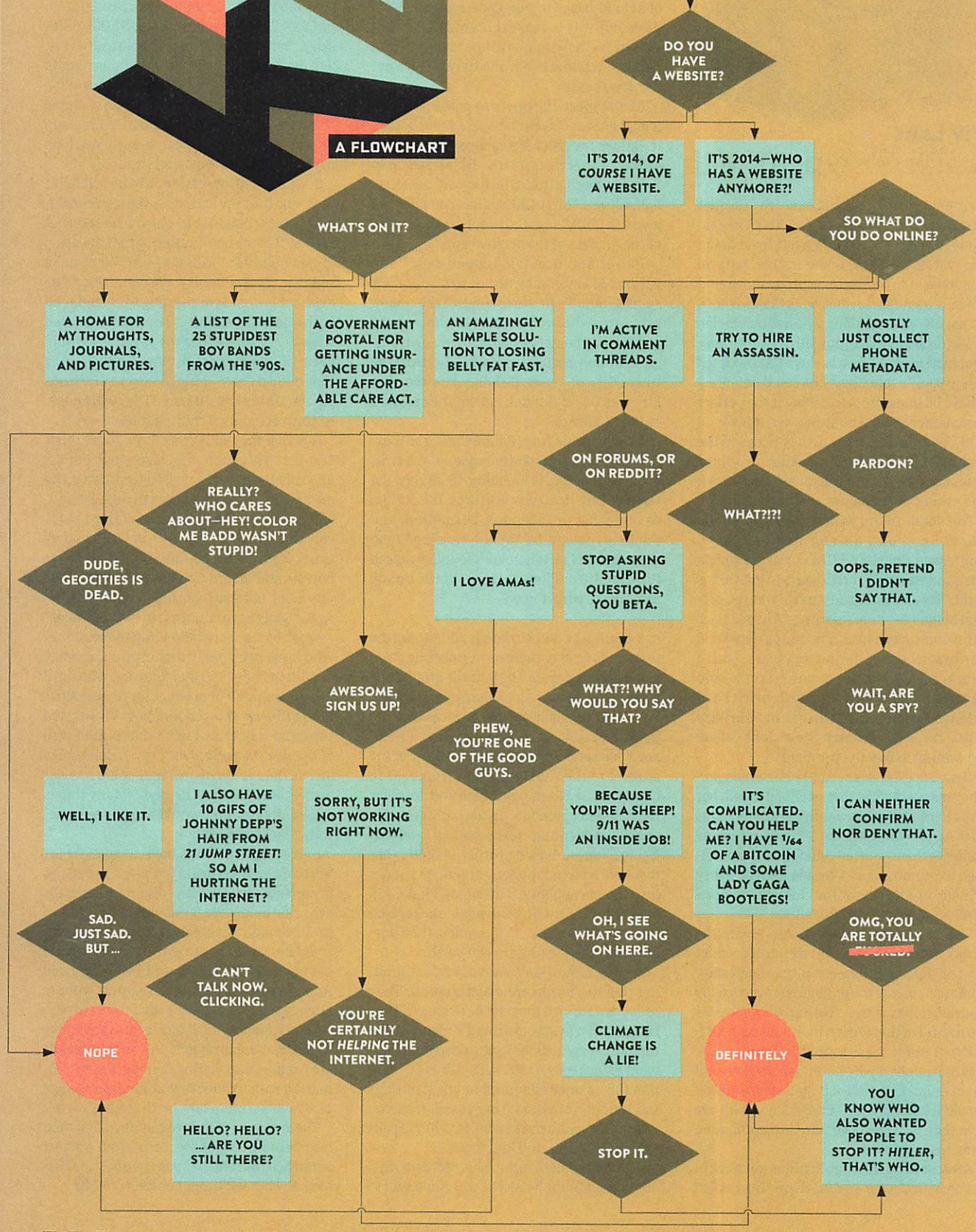
The inventors of Siri are confident that their next creation will eclipse the first. But whether and when that will happen is a question that even Viv herself cannot answer. Yet. W



A FLOWCHART

AM I HURTING THE INTERNET?

by Robert Capps



ADVERTISEMENT

BLACKLIST

GET WITH
THE PROGRAM
ED'S SHOCKING
EXT MOVE

ON THE LIST
OFF THE GRID
TRACKING THE CRIMINALS
STILL AT LARGE

CRASHING
THE SYSTEM
ID RAYMOND REDDINGTON
ORRUPT THE FBI?

CODE RED!

HOW ONE MAN HACKED HIS WAY INTO THE ZEITGEIST

THE BLACKLIST SEASON PREMIERE MONDAY SEPT 22 • 10/9c NBC

©2014 Cartier

Cartier

CALIBRE DE CARTIER DIVER

MANUFACTURE MOVEMENT 1904 MC

WATER-RESISTANT TO 300 METRES, THE CALIBRE DE CARTIER DIVER WATCH IS AN AUTHENTIC DIVING WATCH. FITTED WITH THE 1904 MC MOVEMENT, IT COMBINES THE HIGH TECHNICAL REQUIREMENTS OF THE ISO 6425: 1996 STANDARD WITH THE ASSERTIVE AESTHETICS OF THE CALIBRE DE CARTIER WATCH. ESTABLISHED IN 1847, CARTIER CREATES EXCEPTIONAL WATCHES THAT COMBINE DARING DESIGN AND WATCHMAKING SAVOIR-FAIRE.

EXPLORE AND SHOP WWW.CARTIER.US - 1-800-CARTIER